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PUBLIC UTILITIES LEGISLATION.

The attention of the public all over the country is taken up with proposed legislation and "remedial measures" with respect to corporations and "monopolies." The steam railroad systems are in particular the object of these impolite intentions; and the body of new laws devoted to their affairs is simply astounding, while not a little amusing in some instances, as for example the suspension or abolition of a through train if it happens to be a little late. As is usual in America, a good thing is being overdone and run into the ground; and pretty soon there will come the reaction, of which some of the signs are now in evidence.

Meantime, among the special measures to be noted, is the Public Utilities bill now before the New York Legislature, supported by Governor Hughes. We gave an abstract of its leading points last week. It proposes two commissions, one for Greater New York and one for the other part of the State; to which bodies all public utility matters heretofore treated by specific commissions will be referred. On the whole, the measure seems a good opinion, but it apparently goes much too far in compelling corporations to carry out the orders of the commissions at once, when given, without appeal. That seems to involve opportunities for the gravest kinds of abuse and injustice, as well as infinite danger to public life and limb. There must be a check imposed somehow, on such arbirary power. In like manner the clauses as to capitalization seem to involve a risk of checking real or prospective development, especially where companies are consolidated whose capitalization cannot possibly be measured in equal terms.

It would appear that all the ten commissioners are to be "business men." At any rate, no provision is made for the inclusion of any engineering talent in the commissions, while the salaries of $10,000 would certainly command men of high calibre. Possibly this point has not been brought to the Governor's attention or emphasized in debate. In corporations to-day, however, it is engineers who are coming to the top, and commissions may well be made up on the same lines of technical advance.

VARIABLE-SPEED MOTOR RATING.

In the schedule of the proposed changes in the "National Electrical Code," to be considered at the next meeting of the Electrical Committee of the Underwriters' National Electric Association, to be held on the 27th of this month in New York, there is an interesting report from the committee on variable-speed motors. The committee proposes that all variable-speed motors must be marked with the maximum current that they can safely carry for five and for thirty minutes respectively, starting cold. This suggestion in regard to motors intended for intermittent service seems good, simple and desirable. If,

however, it is to be useful, it should be made more definite. Who is to say what starting cold means, or what is the heating which a motor may safely stand? It would seem necessary to define these conditions. For example, unless otherwise specified, starting cold ought to mean starting from a standard room temperature of 25°C. and the temperature elevation produced in the five-minute or thirty-minute application of steady current strength should be, say, 40°C. or 65°C. under standard conditions.

A useful list of estimated average "times" for various kinds of service is given in the report. In the 5-minute class are valve-operating and the raising or lowering of rolls, tool-heads, etc. In the 10-minute class are hoists, rolls, ore and coal-handling machines. In the 15-minute class are freight-elevators and shop-cranes. In the 20-minute class are passenger-elevators, and in the 30-minute class, rolling-tables and pumps. To find the current rating for an intermediate time between 5 minutes and 30 minutes, the committee recommends simple interpolation. This may be safe from the standpoint of installing conductors; but it may lead to ridiculous results from the standpoint of motor heating. Thus in the sample case taken by the committee, a shop-crane rated at 110 amperes for 5 minutes and 50 amperes for 30 minutes, would by simple interpolation be rated at 86 amperes for 15 minutes. This, however, would make it much too hot. An approximate 15-minute rating would be nearer 67 amperes. The interpolation should be better based upon the total joules of heat under the formula I^2T, than upon the total quantity of electricity, or simple straight-line interpolation, corresponding to the formula IT, where T is the time in seconds, and I the current in amperes.

Motor-Starting Rheostats.

Among the sections of the Underwriters' Electrical Code which will be discussed at the meeting of the Code Conference Committee to be held in New York City on March 27 and 28, that of perhaps greatest importance relates to motor-starting rheostats. As very few changes in rules and regulations relating to rheostats have been introduced in the Code since its first edition, it is a fair assumption that this device has been neglected by the Underwriters in the past, and that the approaching meeting will probably result in some important changes in, and additions to, this section of the Code. From the Underwriters' standpoint alone, the rheostat which presents no fire risk whatsoever is to be preferred to one which under certain imaginable conditions may cause a fire, and there are some who suggest that if the former can be realized the use of the latter should be prohibited. But a similar course of reasoning carried to its full consequence would lead to the abolition of the direct-current motor in favor of the induction motor for all conditions, because the fire risk of the latter is infinitesimal in comparison with that of the former. For their own interest, which is likewise in conformity with the interest of the users of rheostats, the Underwriters should insist on the use of motors and rheostats so installed and equipped that the outfit as a whole cannot cause damage by fire. It seems reasonable, however, that the operating characteristics of the equipment and the service to which a rheostat is to be put should not be entirely ignored. One of the present rules that is not always lived up to in the construction of rheostats, relates to the prohibition of combustible material within the rheostat. A rigid enforcement of this rule would prove of advantage to all parties concerned.

The electrical committee of the National Electric Association has received numerous suggestions for changes in its rules relating to rheostats, among which is the somewhat enigmatic one reading as follows: "For motor-starting rheostats of small or medium size, the material of the resistance should be such that it will not change its value with rise of temperature." It is not stated whether *value* refers to the initial cost of the rheostat wire, its length or its weight in pounds, but it is probable that the proposer had in mind cases in which it is desirable that the resistor material of a rheostat should not suffer a change in resistivity with a rise in temperature. The rigorous enforcement of a rule thus phrased would mean the abolition of every type of resistor material ever used commercially for rheostats, but as suggested it probably was intended to refer solely to iron. Although the gradual increase in the resistance of the final sections of a rheostat does produce the effect of decreasing the active number of operating points on the rheostat when the motor starts up slowly under excessive load, and calculations for determining the amount of resistance to be included between the successive notches are thus not the same as when a resistor material is used whose resistivity does not change with the temperature, yet this fact of itself does not appear sufficient to justify such a sweeping elimination of iron as a resistance material. In other words, if a satisfactory performance can be obtained from an iron-wound rheostat when it is properly designed with relation to its prospective use and elimination of fire hazard, it should not be condemned merely because it is of iron and is not constructed according to formulas relating to some other material. The criterion that should be applied in the formulation of Underwriters' rules is that the rules should be confined so far as possible to performance, and not refer except as a disagreeable necessity to design and materials by which these performances are obtained—a criterion which in its unqualified form has safely guided the A. I. E. E. Standardization Committee in its great work which has met with such rare appreciation.

Technical Graduates and Central Stations.

Elsewhere we print a most interesting contribution by Mr. Henry L. Doherty to the discussion on Prof. Shepardson's article on the subject of technical graduates and central stations. Mr. Doherty is probably the largest employer in the United States of technical graduates in central-station work, and his opinion of their value in this work is, therefore, of exceptional interest. Moreover, this opinion is not merely that of an employer, but also of one who takes a sympathetic interest in the career of every one he associates with his work. The principal cause which has led to difference of opinion as to the value of technical education, or as to the present organization of technical instruction in our schools, has arisen from what appears to us to be a gross misapprehension as to what is to be expected of the young man as he steps from the academic into the work-a-day world. The situation in this respect would be finally clarified if some technical graduates and some employers would recognize the fallacy of the old-time view that the possession of an engineering degree, fresh from the pen of the engrosser, is, or should be, evidence that the holder is an actual engineer.

The major requirement of the engineer is judgment derived from contact with commercial engineering, and it is little to the credit of the understanding of those who inveigh against technical education—as in a recent discussion on that subject—because in their experience they have found the callow technical graduate lacking in the qualities they think essential to a competent engineer, and requires a couple of years—to use their expression—to be made over; or, correctly speaking, to add to his incomplete professional equipment those essential qualities of an engineer which under no circumstances can be acquired at school. As we have repeatedly pointed out, the experience of the past twenty years has conclusively shown that the graduate can only be considered raw material and not a finished product in any sense; and, moreover, that as raw material he is fitted equally for a career in any deparment of the electrical industry, whether technical, administrative or commercial. We are glad to find a specific confirmation of this opinion in the wide experience of Mr. Doherty, which is that the graduate can give better service in the commercial department of the central station than the man lacking his technical training. That in coming from school the graduate can only be accepted as raw material should not be a source of discouragement to him; for, as pointed out by Mr. Doherty, the training he has received represents a form of capital which, unlike capital in the form of money or property, can never be alienated. To quote from the article: "A good education, backed up by proper training, represents a particularly desirable form of capital. It cannot be unwisely spent or mortgaged. It can often be made to have an earning power equivalent to $500,000 in cash."

MEASUREMENT OF WIRE AND CABLE INSULATION.

Everyone familiar with insulated wire testing is acquainted with the expression "megohms-per-mile." A certain cable is stated, for example, to have an insulation of 500 megohms-per-mile. This is intended to mean that any single mile of such cable would have, on the average, an insulation resistance of 500 megohms. The expression is, strictly speaking, illogical and incorrect, because it leads to the deduction that the insulation resistance is proportional to the number of miles; or that 2 miles would have 1000 megohms of insulation-resistance, 3 miles 1500 megohms, and so on; whereas the facts are contrary to this deduction, 2 miles having about 250 megohms, and 3 miles 167 megohms. A more logical expression is that the insulation of the cable averages 500 "megohm-miles," and this expression frequently appears in the statements of careful writers. However, the use of "megohms-per-mile" is so common, that it is almost pedantic to protest against the error and inversion of ideas that its use involves. When a great length of uniform cable is tested, and particularly when a great length of leaky cable is tested, the insulation of a single mile, as computed from direct galvanometer deflection test, usually comes out too high, and higher than the average of single mile lengths. As is well known, this is due to the *IR* drop in the conductor of the cable under the influence of the leakage current *I*, passing through the conductor resistance *R* of the cable, whereby the more distant miles are virtually tested with a lower voltage than the miles close to the testing end. This reduction in the testing voltage towards the distant end reduces the leakage current in corresponding measure, and makes the total galvanometer deflection unduly small, or the apparent "absolute insulation" unduly great. There are simple formulas, however, for correcting the deflection and apparent insulation, if the leakage along the line is uniform.

Except when, as above considered, the length of cable tested for insulation is so great as to produce an appreciable *IR* drop in voltage between the testing end and the distant free end, it is generally agreed that uniform cable will give uniform linear insulation resistance in water at uniform temperature, whether the cable be tested in short lengths, or in long lengths. In other words, it is generally agreed that such cable would show an insulation of say 500 megohm-miles whether tested in lengths of one-tenth of a mile, or in mile lengths, or in ten-mile lengths. In the article by Mr. F. Wachter, appearing on page 593 of this number, it is contended that, at least in certain cases, the last proposition is not true, and that different lengths of physically uniform cable will show, under deflection test, higher insulation in megohm-miles as the length increases up to, say, a mile. Thus taking the figures offered in the article, as lengths of 500 ft, 1000 ft, 3000 ft and 1 mile are selected, the indicated insulation will be 387, 608, 852 and 932 megohm-miles respectively. This is clearly no petty question of a few per cent in linear insulation resistance; but a question of 141 % increase in apparent megohm-miles between 100-ft lengths and mile-lengths. The discrepancy is so great that we are justified in challenging it. Insulated wires have been used immersed in water for about sixty years, and there has been at least fifty years of experience in the testing of such wires in water under all sorts of conditions and in all sorts of lengths. A discrepancy in linear insulation so marked as that reported in the article could not have escaped notice if it occurred in general commercial practice. So far as we are aware, no such discrepancy has been recognized. If this discrepancy really occurs in any particular quality of wire or cable insulation, it is very important that the facts should be thoroughly studied and ventilated.

The facts as they are reported in the article are capable of being explained by leakage on the galvanometer, the leads, or the ends of the insulated cables; and since nothing is said in the article about the investigation of leakage, we are entitled to this simple explanation until evidence is produced to make it untenable. Thus, in the illustrative diagram accompanying the article, it appears that when the length of tested cable is reduced to only a few feet, or practically nil, there would remain a galvanometer-deflection of about 7 divisions. The only logical explanation of this residual deflection is a local leakage current. If we subtract 7 divisions for local leakage current from all of the reported observations, we obtain 3.5, 7, 23 and 42.6 divisions of corrected deflection on lengths of 500, 1000, 3000 and 5280 feet, respectively. These deflections represent linear insulations of approximately 1250, 1250, 1150 and 1100 megohm-miles respectively, which are reasonably alike. The question is of such technical and industrial importance that efforts should be made to clear it up without delay; and if any such effect of length on the apparent linear insulation exists as the article suggests, the sooner we can accumulate evidence to establish it, the better for all interests; but we ought not to believe it until the evidence is overwhelming.

Cost of Electrical Power Service at Kyoto, Japan.

The municipality of Kyoto, Japan, operates a water-power plant developing a maximum of about 2000 kw, which supplies light and power service within the city. In the near future the plant will be enlarged by the addition of about 5000 kw, also to be generated by water power. Following is the tariff of charges for power, on the basis of 12 hours service per day:

Under	5-hp.				$47.50	per hp	per year
Between	5	and	10-hp.		39.00	"	"
"	10	"	20	"	36.00	"	"
"	20	"	30	"	33.00	"	"
"	30	"	50	"	28.50	"	"
"	50	"	100	"	26.50	"	"
Above	100-hp.				24.00	"	"

For service between 10 and 12 hours, a proportional reduction is made, and a proportional increase for service between 12 and 14 hours. For service longer than 15 hours per diem there are special rates.

An Electrical Secret.

The following letter, signed Wilson B. Strong and dated from Georgetown, D. C., appeared recently in the New York *Tribune:*

"Through the Hon. Wilson G. Hunt, as Wilson G. Hunt Strong, I, in 1864, when an infant, became possessed of a small interest in the first successful Atlantic cable, and yet have my certificate in the Atlantic Telegraph Company, now, I believe, known as the Anglo-American Cable Company. I was named after Mr. Hunt, who wanted to adopt me on the death of my father, Major-General George C. Strong, who was promoted when on his deathbed by President Lincoln. A small knowledge of electricty led me later to be treated as if of their age and standing by Messrs. Field, Cooper and Morse, from whom I learned much. When Marconi, De Forest and others proved that wireless telegraphy was practical I looked into wireless telephony, and with the result that I was looked upon by my relatives, friends and others just as Mr. Hunt told me Mr. Field was when he first proposed the so-called 'ridiculous idea' of the possibility of telegraphing under the ocean for a distance of over 2000 miles. The only newspaper item that appeared about my little contrivance was on April 28, 1902, under the startling caption, ''Phones Five Hundred Miles, but Uses No Wires.' My experiences in trying to get people interested in my little invention so disgusted me that I turned the matter into jest, and when people asked to see my wireless telephone I showed them a 'phone with twine, instead of wire—just as a wagon or carriage drawn by a steer is known as the original horseless carriage. A 'coherer' is not needed in my idea, the original model of which I destroyed. I happened to catch an idea that I do not think one man in ten million will learn of, and, like the Wright brothers, of Dayton, Ohio, whose secret work on flying machines is exciting much interest, until I am in a position to patent, push and protect by the best legal talent that money can command, I will not let my secret out. It may die with me, but some one will find it later, as I believe, after being lost for centuries, the secret of Greek fire was again found. You are safe in predicting that within a century human speech will be carried hundreds of miles over the sea and, perhaps, over the land. It is now carried some ten miles, I believe, from a point just south of Boston to the fishing fleet near Cape Cod."

Meeting of Purdue Branch, A. I. E. E.

The Purdue Branch of the American Institute of Electrical Engineers met in the lecture room of the Electrical Building, Tuesday evening, March 5, to discuss the paper by Messrs. Stillwell and Putnam on "The Substitution of the Electric Motor for the Steam Locomotive." There was a good attendance, including many members from the department of mechanical engineering.

The discussion was opened by Prof. H. T. Plumb, of the electrical engineering department, who gave a review of the paper. Dr. W. F. M. Goss, of the mechanical engineering department, followed giving a discussion of the subject from the view of the mechanical engineer. He pointed out that the general conclusions drawn by the authors were based on the assumption that all steam roads were electrified. He called attention to the fact that this is a condition that will not exist for a long time to come, and that, therefore, it is doubtful whether a single road, or a number of roads, when electrified, would show the economy which might be expected.

Dr. Goss stated that the problem in steam operation of railroads was not so much one of motive power, as of operating conditions. He did not believe that one-half the number of electric locomotives would be able to do the work of the present number of steam locomotives, even though the electrics have double the tractive effort. A freight locomotive, operated by steam, shows a small yearly mileage, not because it is in the shops so often, but because so much time is wasted on sidings. The same conditions would militate against electric locomotives in freight service.

Prof. J. W. Esterline, of the department of electrical design, discussed the effect of the frequency upon the design of the motors and generators for railway work.

The meeting was well attended and the discussions were well prepared.

Growth of Worcester Polytechnic Institute.

The thirty-seventh anual catalogue of the Worcester Polytechnic Institute has just been issued. The book contains 221 pages, and besides the matters of general information that are repeated from former catalogues, it presents some new material that deserves especial mention. The plan of the institute grounds, showing the buildings, roads, elevation coutours, now published for the first time, includes the estate of the late J. Henry Hill, at the corner of Salisbury and Boynton Streets, which was purchased by six of the alumni last summer and presented to the institute. The possession of this piece of property completes the ownership by the institute of the entire plot bounded by Boynton, Salisbury and West Streets and Institute Road.

In the present catalogue, particular mention is made of the new Electrical Engineering Building, and views of the building, interior and exterior, are inserted. A full description of the building and of its equipment is given, and from this description it can be seen that the institute will, by the opening of the next academic year, have at its disposal facilities for work in electrical engineering unsurpassed by those of any engineering school in this country, if not in the world.

The number of professors and assistant professors, composing the faculty, is eighteen. During the past year one new chair was established in the department of civil engineering, that of railroad engineering. The first incumbent is Assistant Professor Howard Chapin Ives, who has been for three years assistant professor of civil engineering at the University of Pennsylvania, going there from a three-year service at the Institute as instructor in civil engineering. Other changes in the faculty to be noted are the appointment of Prof. George I. Rockwood to the chair of steam enginering and the promotion of Professors A. L. Smith and C. M. Allen from assistant professorships to full professorships of drawing and experimental engineering, respectively. There are twenty-seven instructors and assistants, and this list grows every year.

Perhaps in no way can the growth of the institute be better shown than in the number of students enrolled each successive year. The present catalogue shows 12 graduate students, 65 seniors, 87 juniors, 112 sophomores and 161 freshmen, a total of 437, against 388 last year and 325 the year before. An interesting summary of the student body, printed at the end of the student register, indicates that the percentage of students coming from outside of Worcester and Worcester County is

steadily increasing, thus showing that the institute each year loses more of its local character and takes on a national reputation. The present enrollment shows that the number of students from outside Worcester and its tributary towns is largely in excess of the number of those from within.

A register of graduates is printed at the end of the book which gives the present addresses and occupations of the alumni. Including the class of 1906, thirty-six classes have graduated, numbering 1,142 men. During this time 2,211 students were enrolled in the institute, making the percentage of graduates 51. Of the 1,142 graduates, 74 have died, and the geographical register printed in the catalogue shows the 1,068 living alumni, distributed through 38 states and territories and 13 foreign countries.

The interest of the alumni in the Institute has never been greater than during the past year. They have recently secured a tract of about six acres of land on West Street, being a portion of the Bliss estate, to be known as Alumni Field, and to be used for the various athletic interests of the student body. The catalogue gives the names of nine alumni associations, covering the entire country.

The catalogue contains the usual amount of information in regard to the courses of study offered, both undergraduate and graduate, the accommodations and equipment, both of which are being added to and improved constantly, and the other features which have given the Institute the reputation as an engineering school that it now enjoys.

Motor-Starting Rheostats.

BY GEORGE T. HANCHETT.

Referring to the proposed legislation on the part of the Underwriters' National Electric Association at the fifteenth annual meeting, and with particular reference to the report of the committee on the construction and installation of motor-starting rheostats, it appears to the writer that the suggesed modifications with reference to Rule 60 and Rule 8, while commendable in their purpose, leave much to be desired as far as the accomplishment of their avowed intent is concerned.

The obvious object of the change is to improve the quality of motor-starting rheostats, thereby reducing the fire hazard and incidentally increasing the cost. It cannot be denied that any motor-starting rheostat carrying current temporarily is a fire hazard, and as long as such rheostats are used, that is to say, those which would burn up if continuously used on maximum current that they carry, it will be necessary to provide regulations with reference to the details of their construction. If the motor is blocked and the rheostat turned to the first button and held there indefinitely, the rheostat will ultimately burn up with certain attendant flame and smoke, and it is plain that the construction should be so specified that the surroundings shall not catch fire when the worst happens. This appears to the writer to be a good and sufficient reason for promulgating the rule that the starting box shall not emit flames or spit hot metal. It is hardly possible with any form of construction to avoid smoke and smell.

The association is most interested in the rheostat when it is under its severest duty, viz., when it is connected practically directly across the line through the negligible resistance of the motor armature. This is a fire hazard in which the Underwriters are interested and its performance under such conditions are the points of vital importance. It would seem enirely within the province of the committee to determine accurately the amount of heat permissible and the containing space and radiating surface surrounding it. This can be very simply specified and the following suggestions may be of interest.

First. Adopt the assumption that the starting rheostat should be able for a brief period to carry the full power absorbed by the motor armature under a full load plus a certain excess. It would perhaps be convenient to figure a kilowatt as a horsepower, which would leave a margin which ought to be abundantly suitable.

Second. Specify accurately the radiating surface per momentary kilowatt. This limits the temperature, other things being equal, and puts all the rheostat makers on the same basis. It should not be an arduous task for a committee of manufacturers and experts to prepare a table giving the maximum ohmic resistance and the radiating surface, and the minimum number of points on starting rheostats of all sizes and voltages.

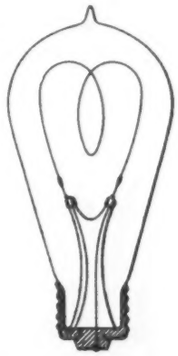
This has the effect of making the time element in which the rheostat will destroy itself and the temperature of its surroundings a uniform quantity, whatever the make, and fixes the hazard at a figure that may be thought best.

In closing, it may be pointed out that the spitting of live metal or flame and smoke may be entirely avoided by inserting in the circuit within the rheostat a fuse which shall melt, not by virtue of the current that it itself carries, but by virtue of the temperature of its surroundings; and if this fuse be properly housed there will be no flame or smoke or uproar of any kind.

Naturally this fuse should be so constructed that it will be very difficult to bridge with any extemporized device, but it should, nevertheless, be readily renewable. It should preferably be made of ordinary fuse metal so that when replaced with materials at hand it will still possess the properties for which it is intended. Such a protective device will not be easily overfused, for its breaking point is not very largely dependent on its section. Increased section would merely affect the time element and would not prevent the fuse from blowing. A section of the rheostat wire coiled tightly around a porcelain tube, through which the fuse is threaded, suggests itself in this connection and a little attention to detail would be sure to produce a satisfactory result.

Leading-in Device for Incandescent Electric Lamp.

In the electric lamp illustrated herewith platinum is entirely dispensed with and copper or iron is used as the material for the leading-in device. The upper end of the central glass tube is provided with separate tubular extensions, the open ends of which are hermetically sealed in the following manner: Over each extension is placed a cap of copper or iron. The parts are then heated in the ordinary glassblower's gas-jets to a temperature sufficient to soften the glass. A gentle air-pressure is



WHITNEY LAMP.

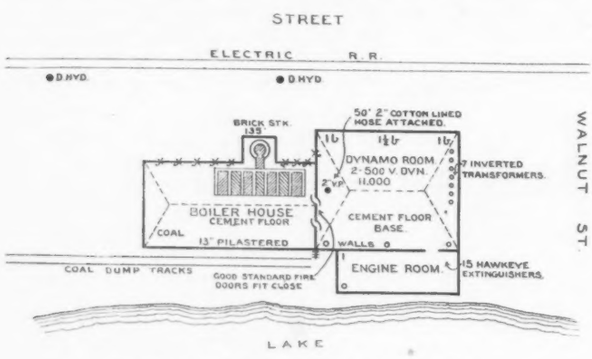
then exerted, so as to bring the glass into intimate contact with the sides of the cap. Upon cooling, the cap shrinks tightly about the glass and forms a perfect vacuum-tight joint about the same.

The inventor of the lamp, Mr. W. R. Whitney, in the patent issued Feb. 5, states that the joint is probably assisted by some combination between the oxidized surfaces of the metal and the parts of the glass in contact therewith. The metal is sufficiently thin so that it will stretch and will thus not exert such a pressure upon the glass as to shear or break the same. A thickness of metal one one-hundredth of an inch or less has been found to be satisfactory.

Record of Recent Fires.

The quarterly bulletin of the committee on special hazards and fire record, for the National Fire Protection Association, has issued its January number, which contains a large variety of interesting information as to the subject of fire. There are special articles on mechanical refrigeration, risks in the printing business, denatured alcohol, etc. The miscellaneous section deals with special occurrences, among which may be noted the record of the power house fire at Wolcott, Kan., last September, and the fire at Auburn, Me., last December. They are noted below as follows:

The power house at Wolcott, Kan., was a two-story and basement brick, slated-roof building with one-story brick engine room attached, not cut off, also one-story brick boiler house, cut off. The fire started in the oil transformer in the basement under the dynamo and engine room, and was probably due to overloading the oil transformer. It is stated that the machinery was much overloaded and plant is reported to have been about half the proper capacity. It is stated that the fire spread very rapidly, being almost in the nature of an explosion, and it was only a short time before the engine room addition was all on fire. The roof fell in and broke down the upper portions of the fire wall between the boiler and engine room, allowing the fire to pass into the boiler room, entirely destroying the plant. There was some private fire protection in the nature of standpipe and yard hydrant supply, said to have been supplied by gravity pressure from the lake, also a pump, the latter probably being put out of commission almost immediately owing to the breaking of the steam pipes. A very fairly constructed power station with boiler house cut off and with weak outside protection was thus totally destroyed.

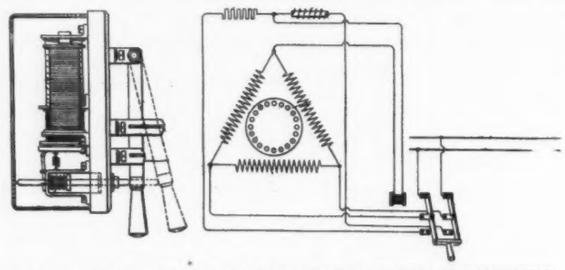


PLAN OF POWER HOUSE AT WOLCOTT, KAN.

At Auburn, Me., the fire occurred at 9.55 a.m. and was caused by a wooden gear on the water shaft slipping, and coming in contact with the bridge-tree, which was ignited by friction. The station was totally destroyed, causing a loss of between $15,000 and $18,000. There was no insurance on the plant. The station was of frame covering an area of about 400 sq. ft., the main building being 95 ft. by 35 ft., with an ell containing the boiler, wheels and belt-way of about 28 ft. by 28 ft. The main building was about two stories with basement, the ell being one story, but in part below the level of the basement floor as the plant was situated on the bank of the river. The roof was shingled, with floors of joist construction. The heating was by steam from the boiler referred to, the lighting electricity and the power water. The dynamo room was on the first floor, the one machine, a 180-kw, 200-volt, two-phase Westinghouse, being run by belt from main shaft in the basement, this main shaft being driven by belt from a waterwheel. The second floor was not used. The fire was discovered by the attendant smelling smoke, opening the trap-door to the stairway leading to the wheels and finding the stair and belt-way full of smoke and well going. The plant was located about one and one-quarter miles from the center of Auburn, outside of protection, so that nothing could be done to check the fire. The fire is an illustration of how a fire may start in a "damp and wet" place and is a reminder that in equipping plants with sprinklers such locations should not have the sprinklers omitted.

Starting of Single-Phase Induction Motors.

A familiar method of starting single-phase induction motors from rest consists in the use of "phase-splitting" devices and auxiliary windings. Ordinarily such starting devices are designed for operation for only a short time and if left too long in circuit with the motor would become overheated. Moreover, when the motor is up to speed the efficiency is generally better if the devices are cut out of circuit. A patent issued March 12 to Mr. A. E. Everest describes means for cutting out the starting circuits automatically when the proper speed has been reached. The mechanism is illustrated in Fig. 1, while its connection in the motor circuits is indicated in Fig. 2. The primary winding of the motor is of the three-phase type, and the starting circuits include the usual resistance and inductance shunted across the auxiliary phases. The point of connection between the resistance and inductance is joined to the third terminal of the motor through a plunger magnet winding of low impedance. Under starting conditions a large current passes through the magnet winding, but the current reduces almost to zero at a certain high speed. The magnet serves to hold the starting switch in its initial extreme closed position, until the magnet current reduces to a sufficiently low value, when a spring moves the switch lever automatically outward from engagement with the shorter contacts into the running position shown in Fig. 1.



FIGS. 1 AND 2.—STARTING SWITCH AND CIRCUIT CONNECTIONS.

A method of using a condenser both for starting purposes and for improving the running conditions of a single-phase motor is disclosed in a patent issued March 12, to Mr. E. J. Berg. The connections employed are illustrated in Fig. 3, where the condenser is arranged for starting. The switch in the condenser circuit allows the condenser connections to be shifted from 120 electrical space degrees displacement from the main winding at starting to 90 space degrees under running conditions, thereby improving the power factor and the efficiency. The least active

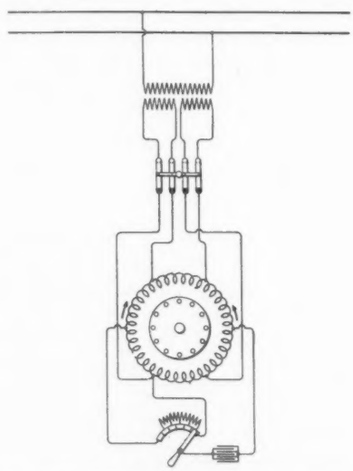


FIG. 3.—CONDENSER AS A PHASE SPLITTER.

portions of the primary windings of the motor are omitted from the main running circuits in order to avoid any loss of power in them, but they assist in producing torque under starting conditions and contribute to the effectiveness of the condenser under running conditions. The above patents have been assigned to the General Electric Company.

Two patents issued February 10 to C. R. Meston and H. I. Finch, and assigned to the Emerson Electric Manufacturing Company, disclose means for allowing the armature of a single-phase induction motor to accelerate from rest without being mechanically connected to the shaft and for automatically cutting out the starting coils and coupling the armature to the shaft when the proper speed has been reached. The motor is provided with an unsymmetrical two-phase stationary primary winding, consisting of the main coils and the starting coils.

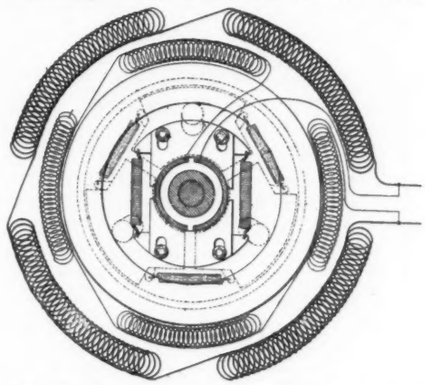


FIG. 4.—CENTRIFUGAL CHANGE-OVER DEVICE FOR SINGLE-PHASE MOTOR.

The secondary rotor winding is of the squirrel-cage type. The rotor is arranged to revolve freely on its shaft in attaining speed, and clutch devices are thrown into operative position when the desired speed is reached, and the rotor is coupled to the shaft by friction devices. The automatic coupling mechanism serves simultaneously to clamp the shaft and to cut out the starting coils when full speed is reached. The starting-coil circuit is completed through two segments of a divided contact-ring (Fig. 4) in contact with which are two plates attached to the coupling mechanism, which are thrown outward by centrifugal force at a certain predetermined speed somewhat below normal synchronism.

CURRENT NEWS AND NOTES.

TAXING CORPORATIONS.—A new fiscal scheme providing for the taxation of public utilities and other financial concerns in Alberta, Canada, contains the following specific features: Street car lines pay $200 per annum, and $10 per mile. Telegraph companies pay $1 a mile, telephone companies twenty to fifty cents per instrument, according to the size of the city.

MEETING OF A. I. E. E.—The 217th meeting of the American Institute of Electrical Engineers will be held in the Auditorium of the Engineers' Building, 33 West 39th Street, New York, on Friday, March 29, 1907, at 8 p. m. Papers on "Lightning and Lightning Protection," will be presented by Messrs. C. P. Steinmetz, E. E. F. Creighton, and D. B. Rushmore.

CHICAGO CANAL POWER.—The sanitary district trustees wish to remove the dam at Joliet, Ill., now rented to the Economy Light & Power Company, of Chicago. This is to carry out a deep waterway scheme. The Illinois-Michigan Canal Commissioners, which get the income from this dam, strenuously oppose this. Messrs. L. E. Cooley, Isham Randolph and Leon McDonald are appointed a committee to try to work out a compromise.

LAKE SUPERIOR POWER.—The Michigan-Lake Superior Power Company has shut off part of the water flowing through the power canal, in compliance with an order of the federal authorities, who claim that the level of Lake Superior is actually being lowered by the little quantity of water taken by the power company. It is stated that half of the plant of the Union Carbide Company will have to be shut down on account of the curtailment of the water-power supply.

HONORS FOR LANZA.—Prof. Gaetano Lanza, head of the mechanical engineering department of the Massachusetts Institute of Technology, has been honored by King Victor Emmanuel of Italy with knighthood in the Order of Saints Mauricio and Lazarus. The order is one of the most important and ancient in Italy. Its membership is small and is made up of men of signal ability who are of Italian descent. Prof. Lanza was born in Boston in 1848.

PITTSBURG FLOODS.—The city and district of Pittsburg was visited last week by a very severe and well-nigh unprecedented flood, in which several lives were lost and damage was done extravagantly estimated at $25,000,000. The telephone service and electric lighting systems were temporarily interrupted by high water in conduits and plants, and the trolley lines also suffered. The Westinghouse works at East Pittsburg were also under water for a time, but the consequent delay and the damage were not serious.

INSURANCE CODE CONVENTION.—The Electrical Committee of the Underwriters' National Electric Association will meet March 27 and 28 at the rooms of the New York Board of Fire Underwriters, 32 Nassau Street, when the various committee reports and other questions will be taken up. The various changes and suggestions proposed in the National Electrical Code have received attention in these columns. The meeting is the fifteenth annual one and promises to be unusually important and interesting.

THE PARIS STRIKE.—A special cable dispatch from Paris of March 18 states that the Municipal Council has decided to incorporate in certain electric lighting contracts about to be concluded clauses that will insure to the electricians the demands for which they recently went on strike. The socialists have been furious with the government for placing military electricians at the disposal of the various plants, to keep them in operation, but many newspapers and other organs of public opinion have called for legal measures which will prevent the sudden abandonment of machinery on the service from which safety of life and property depends.

EXPLOSION ON THE JENA.—A French wireless telegraph expert has advanced the theory that "wireless currents" were the cause of the great disaster to the battleship Jena, destroyed by an explosion of one of its magazines at Toulon on March 12. The New York *Times* interviewed Prof. M. I. Pupin and Dr. Lee De Forest on the subject. The former stated that if the explosives were kept in grounded metallic cases, the explosion could not have been caused by wireless waves. Dr. De Forest stated that the thinnest sheet of metal completely enclosing a space is an absolute barrier to electrical waves, however intense. High frequency, high potential currents could, however, be induced in a lighting network "from the 'kick-back' of a powerful induction coil or transformer feeding an oscillating circuit and supplied from the same source of electric current. It is also conceivable that from such electric light wires faultily insulated from the steel walls of the magazine and not protected in iron conduits, sparks could jump." The theory advanced by the French expert does not take into account the fact that all explosives in war-ships are kept hermetically sealed in strong metal cases. The magazine can be flooded at an instant's notice, and as the flooding valves are tested periodically, owing to the consequent dampness always present, all electrical fixtures and circuits, if admitted within a magazine at all, would be specially insulated.

DISCRIMINATION AGAINST TROLLEY.—The Chicago & Milwaukee Electric Railroad has filed with the Interstate Commerce Commission a petition against the Illinois Central and the Yazoo & Mississippi Valley Railroad to compel joint rate and traffic arrangements.

MANITOBAN TELEGRAPHS.—Mr. R. P. Roblin, Premier of Manitoba, has announced the creation of a new portfolio, that of Telephones and Telegraphs. He also announced the beginning of construction within 60 days of 1000 miles of lines. This is part of a policy of public ownership. The work will represent ultimately an expenditure of $10,000,000. Contracts are being made in Chicago for equipment.

MOTOR-DRIVEN EQUIPMENT AT SEATTLE.—In the article published in our issue of last week under the above heading a couple of errors crept in. In the second paragraph it was stated that the city derives its water supply 30 miles away. The distance is 50 miles. In the last paragraph but one it was stated that the belt-tension is adjusted by an idler placed about 12 ft. from the pump pulley, whereas 6 ft. is the actual distance. This plant is of H. W. Hawley, not T. W. Hawley as printed.

HER PRISON TELEPHONE.—Mrs. Yohlande Degg, who is confined in a county jail in Alabama, sentenced to a 23-year term of imprisonment for manslaughter, has devised numerous ways of beguiling tedium. She now has a private telephone, by means of which she can chat with her friends whenever it pleases her. Having wealth and political power she has many privileges. They say she keeps the operator busy with her numerous calls. It is the only case known where a telephone has been put in a prison cell.

THE BEAUTY OF NIAGARA.—Conferences have been held in New York this week by Secretary Taft at the office of Mr. Charles McKim with F. L. Olmstead, Frank B. Millet and Mr. McKim concerning the improvement of the American shore along Niagara River below the falls. These experts were designated by Secretary Taft as a committee to make suggestions for architectural and æsthetic improvement of the power plants and factories adjoining the falls on the United States side. Captains John S. Sewell and Charles W. Kutz, Corps of Engineers, were detailed to attend the meeting.

M. O. BURDENS.—A special dispatch from London of March 18 says: "The overthrow of socialism in the English local elections is already beginning to bring good results. The new borough councils in two or three important sections of London announce substantial reductions of the tax rate by a reduction of the estimates of their predecessors for municipal ownership enterprises. The new County Council began work this week. It is struggling with the problem of how far it can reduce or possibly cancel commitments involving many millions for works on municipal ownership lines. Many such schemes, unfortunately, must be carried on, for the city is already pledged in the matter. Hence any rapid reduction of the taxpayers' burdens is impossible."

THE BLOCK SIGNAL.—In a recent report on the numerous railroad accidents, the Interstate Commerce Commission finds that accidents are mostly due to the failure in duty of signalmen, generally telegraphers. "There is no escape from the conclusion that the block system is the best known instrumentality for the prevention of collisions," says the report, "notwithstanding the imperfections which have been shown in the results of its operations, and that the highest standard, both of the public requirements and of expert railroad opinion, call for its general use. The most progressive railroads are using the system extensively and are extending it, and their signal engineers and operating officers are constantly striving to make it perfect. The question of safety, as compared with the other system (that is, the old dispatcher and time system), hinges on the efficiency of the signalman." It is conceded, however, that better service is required from the telegraphers than is now obtained, due in part to the long hours, now reduced to nine a day by the La Follette law.

LEGISLATION IN INDIANA.—The recent proposed measures in the Indiana Legislature fixing rates for electrical energy, etc., and affecting all public utility corporations in the State were recommended, but did not pass, as has been reported, and the Legislature has now adjourned. Mr. H. W. Frund, the well-known manager of the Vincennes Light & Power Company, and compiler of our moonlight schedule, writes as follows: "Indiana companies are having a difficult time to realize money from capitalists outside the State, for the purpose of taking care of the increase and of new business. It is to be regretted that in our State Legislature from time to time vicious measures are introduced which, if passed, would almost be a virtual confiscation of property. I should be pleased to have some one take up this question and suggest a way of prohibiting unfair legislation. I am of the opinion that the only way this can be done is by commission similar to that in Massachusetts. Utilities companies in Indiana never know what to expect, and conditions have become such that investors will not take up Indiana securities, not knowing what inequitable laws the Legislature will next attempt to pass."

NIAGARA POWER.—At Albany, on March 14, Assemblyman Murphy, of Kings, introduced a bill to repeal the charter of the Niagara County Irrigation & Supply Company, which the State granted in 1891. This is practically the first bit of legislation directed against Niagara power deals that have been proposed this session. A special dispatch says: "The charter permits the construction of a canal which it is estimated will drain the Falls of 17,000 cu. ft. per second in addition to the 15,600 cu. ft. authorized by permits granted to existing companies by the Secretary of War. The company has not yet begun operations because of lack of funds, it is understood. At the hearing before Secretary Taft its attorney hinted that the General Electric Company was interested in the syndicate which is exploiting the concern. It has been reported at various times that the McKenzie-Mann group of Canadian capitalists was interested in the scheme. The repeal of the charter has been recommended by the Niagara Reservation Commission. It is hinted that legislation to modify the charters of the Niagara, Lockport & Ontario Power Company, and of the Niagara Development Company will be introduced so as to take away the power to divert Niagara's waters."

MUNICIPALISM IN GLASGOW.—In a timely article upon "Municipal Glasgow," contributed by Benjamin Taylor to the March 15 number of *The North American Review*, the benefits and evils of municipal ownership are frankly set forth. While Glasgow, according to this writer, affords "to other cities and countries a good example, she also affords in many other things a warning." To quote further: "While Glasgow is, as has been said, a well-managed city, as cities go, its citizens are by no means unanimous in approval of the management of its affairs. These affairs are in the hands of representatives elected periodically by the ratepayers in the Wards, each representative being seated for three years and eligible for re-election without limit. While it is true that many able and shrewd business men are sent to the Town Council, it is also true that a great many are sent there without the mental grasp or experience to deal with such weighty matters as the Town Council has to control. Men accustomed to small transactions in their own business will quarrel fiercely over some proposal to add £50 a year to the salary of a deserving official, and will then blindly vote for some project that may add a million to the debt of the city. Such men will propose capital expenditure that will please their Wards, without knowing or at all events without appearing to consider, that capital expenditure must ultimately fall upon the ratepayer in some form." Some details are given of the horrible mess made by the city of its costly telephone system, which it has sold out to the government at a dead loss.

JAPANESE EXPENDITURES.—The Japanese Imperial budget for 1907 includes $37,201,000 for communications, presumably including postoffice, telegraphs and telephones. Enterprises for which payment is to be made by public or temporary loans include $1,500,000 for the extension of the telephone system, and $363,000 for electrical work in Formosa.

ARMOUR BRANCH A. I. E. E.—The meeting of the Armour Institute Branch of the A. I. E. E., on March 8, at which Mr. Chas. Jones, chief engineer of the Aurora, Elgin & Chicago Railway, was the speaker, proved to be one of exceptional interest. Mr. Jones held the attention of the audience for two hours on the subject "Some Experiences in Electric Railway Building," in which he gave detailed advice as to the qualifications of the successful engineer. He has had a very wide experience in the engineering field and was able to give much valuable advice to the 90 members and visitors present.

THE KINGSTON EARTHQUAKE.—According to advices from Montreal, where the system is largely owned, President Hutchison, of the West India Electric Company, which operates in the city of Kingston, Jamaica, in a statement to stockholders says that the total losses sustained by the company during the recent earthquake will not now exceed $15,000, and that already the earnings are about equal to what they were in the same period of 1905. There will be a large increase in the company's electric lighting business as the residents of Kingston in erecting new houses are using electricity in place of gas.

THE PUBLIC UTILITIES BILL.—Some opposition to the Public Utilities bill now before the New York Legislature has been developed by lighting interests. The point in the bill which seems most objectionable is that decisions of the Public Utilities Commission are not reviewable by the courts, save on constitutional grounds. In practical work this would mean that a decision of the commission would have to be obeyed at once, without a year or two of delay, while the case was carried from court to court by the lighting companies' legal experts. Another of the arguments against the bill is that the commission would have power to fix prices for gas and electricity and change those prices arbitrarily at any time. Under the present law the price fixed by the State Lighting Commission must remain in effect for three years. Such a power is regarded as dangerous to say the least.

INTERNAL COMBUSTION ENGINES.—The Jas. T. Allen Patent Publishing Company, of Washington, D. C., has published a digest of United States patents granted from 1789 to 1906 on gas, oil, air and caloric engines. The work comprises five volumes containing an aggregate of 4486 pages. Besides the full drawings, claims and brief of each patent granted, the work includes the valuable feature of lists of references cited in the examination of the applications, and statements of interferences with decisions thereon. The patents are arranged in 208 sub-classes, those of each class being in chronological order. The compiler of the Digest is Mr. James T. Allen, examiner in the Patent Office, and a world-wide authority on United States patent publications. Among previous compilations by Mr. Allen are a digest of automobile patents, 1789-1901, digests of various agricultural apparatus, and a former monthly digest of electrical patents.

THE FIXTURES AT HARRISBURG.—An article was published in these pages recently on the electrical fixtures in the new State Capitol at Harrisburg, Pa. Testimony heard last week before the Capitol Investigating Committee showed that the State paid four times the market price for the special art glass furnished for the electric chandeliers throughout the new building by John H. Sanderson & Co., of Philadelphia, under a contract with the Board of Public Grounds and Buildings. Although the schedules provided that baccarat glass, an imported article, should be furnished for the chandeliers and standards, for which Sanderson received $138,757, one of the witnesses testified that to the best of his knowledge and belief there was no baccarat cut-glass in the building. This witness was Henry B. Ebberts, of Pittsburg, secretary and treasurer of the Phœnix Glass Company, which, in pursuance of a contract with the Pennsylvania Bronze Company, of which Sanderson is one of the three incorporators, furnished all of the glass used in the chandeliers and standards, with the exception of the hollow pane and beaded glass. He said his firm was never asked to furnish baccarat and it had not bid on any of the work by the "per foot" or "per pound" system under which Sanderson was paid for the glass and other furnishings and fittings in the Capitol.

SOUTHERN WATER POWERS.—The *Industrial Index*, of Columbus, Ga., in commenting upon the development of Southern water power, says: "Included in the reports this week is notable news of additional developments in Georgia and Alabama of water power of more of the large and numerous streams which in these two States begin to descend through shoals and waterfalls to the level of the sea. Announcement is made that the General Electric Company has purchased the power rights of Jackson shoals, on the Choccolocco, near Talladega, Ala., and will develop this power extensively at a large cost. In addition to furnishing power for manufacturing purposes, an interurban electric railway between Talladega, Anniston and Gadsden, Ala., is contemplated. The Bibb Power Company, Macon, Ga., previously noted, has effected organization, applied for authority to increase its capital stock from $100,000 to $5,000,000, and proposes to develop 37,500 kilowatts of electric power at plants on the Oconee, Ocmulgee and Flint Rivers. It is announced that construction work will begin in the early summer upon a power plant on Little River that will represent, when completed, a total investment of $2,000,000. With the enormous water power developments at Muscle Shoals, in North Alabama, at Columbus, Ga., Albany, Ga., and other points in Georgia and Alabama, readers of the *Index* are familiar. These developments not only represent vast investments of themselves, but they are active and attractive promoters of manufacturing industries of varied character and important and far-reaching factors in industrial growth."

AUTOMOBILE DEVELOPMENT AT ROCKFORD, ILL.—In the ELECTRICAL WORLD of February 17, 1906, in an article on central station work at Rockford, Ill., a description was given of the extensive development of electric automobile business through the central station policy pursued by the Rockford Edison Company. This company, as described in that article, maintains a charging depot in the rear of its offices down-town and has a good storage battery expert who looks after the charging and sees that any petty details likely to give trouble in connection with the batteries or other equipment are promptly looked after. This, taken together with the fact that direct current is available in much of Rockford's best residence district, and that it is a city of good roads and easy grades, has made the electric automobile much more popular, relatively, in Rockford than in any other city of the size in the Middle West. As described in the article mentioned, there were sixty electric automobiles in use in Rockford during the season of 1905. During last season—that of 1906—this was increased to eighty-two. The electric automobile is used in Rockford for business and social purposes, and this, after all, constitutes a larger percentage of the usefulness of an automobile than the touring qualities of the gasoline machine. A man will not get out a gasoline car for a short trip down-town, as it is too much trouble; whereas if he has his electric runabout, it is always ready for an errand. The electric vehicles are used extensively by ladies, and a number of them can be seen lined up in front of a Rockford residence whenever there is an afternoon social function, these machines being driven by the ladies themselves, without attendants. It is found that the life of the positive battery plates when taken care of as they are at Rockford averages about eighteen months.

WIRES AT WEST POINT.—The Government has decided to put in an electric conduit system at West Point and bids have been invited on the subect.

TO BURY THE DEAD.—The City Council of Vienna, Austria, with a view to the municipalization of the undertaking business, has purchased for $500,000 the rights and privileges of two big undertaking companies. The municipality is already operating the gas and electric lighting, the electric street car, and the water services of the city. It has also established a big brewery.

COMMON CARRIERS.—The proposed Public Utilities bill in New York State omits telegraph and telephone companies. A bill has been introduced at Albany declaring express, telephone and telegraph companies common carriers, and placing these companies under the control of the Railroad Commission or its successor, if one be appointed by the passage of the public utilities bill.

EXAMINATION OF TELEGRAPHERS.—The Indiana Legislature has passed an act requiring all railroad telegraphers to submit to a critical examination as to efficiency to be conducted by an expert in the employ and under the direction of the State Railroad Commission. It was asserted that many railroad wrecks are the direct result of blunders on the part of incompetent telegraph operators.

TELEPHONY IN MANITOBA.—By a large majority fully two-thirds of Manitoba has voted in favor of Government-owned long-distance telephone lines and the municipal ownership of local exchanges. Following the example set by Winnipeg a week ago the rural towns have recorded in some instances a vote of 50 to 1 in favor of Government ownership. It will be interesting to note the results ten years hence.

ELECTROCUTION IN NEW JERSEY.—The New Jersey House of Assembly has passed a bill appropriating $10,000 for the erection of a death house to carry out the law providing for electricity as a means of execution in capital cases. The bill passed without any negative votes after a long discussion on the question of a site for the death house. The bill does not designate where the death house shall be built, the electrocution act providing that it shall be at some isolated place to be selected by the State Prison Inspectors.

NICARAGUAN CABLEGRAMS.—Trouble has arisen between the Nicaraguan Government and United States Minister Merry, who believes that his cable dispatches to Washington are being intercepted or read or tampered with by President Zelaya and his officials. Mr. Samuel Weil, in an interview in New Orleans, says: "When Mr. Merry called at the telegraph office, asking to be permitted to make correction of a single word in his cable dispatch, the original, which he had sent two hours previously, was missing from the office and could not be produced. In consequence he surmised that the Government of Nicaragua was attempting to read his message."

NATIONAL HEALTH BOARD.—It is announced that 100 well-known citizens have consented to the use of their names as members of a committee to further the movement for a National Department of Health, which was launched by Prof. J. Pease Norton, of Yale, at the meetings of the American Association for the Advancement of Science held in Ithaca last summer. President Roosevelt, who was consulted, gave as his opinion that the best method to follow was to obtain popular indorsement. The committee named by Prof. Irving Fisher includes Andrew Carnegie, Thomas A. Edison, Archbishop Ireland, John Mitchell, James R. Garfield, Felix Adler, Dr. Leonard Wood and the Surgeon-Generals of the Army and Navy. The committee is pledged to no particular plan.

HADLEY ON OWNERSHIP.—With regard to public ownership of utilities, President Hadley, of Yale University, says: "If any Government agency, local or national, is to be intrusted with the management of an industrial enterprise, a non-partisan civil service is absolutely essential for success. Only where the traditions of the civil service are such that the best men of the country seek and gain admission to it, independent of party, can we hope that the advantages from Government management of these industries might outweigh the evils. With the conditions as they exist in the United States political reasons compel us to reduce Government ownership of fixed capital to a minimum. So long as an administration is to any considerable degree swayed by partisan considerations instead of industrial ones, every extension of Government activity to new fields must be regarded with grave apprehension."

COLLEGE MEN WANTED.—The management of the Pennsylvania Railroad is making special efforts to secure apprentices who have a real technical education. The man who has it proves himself, other things being equal, to be more valuable to the railroad than the one who has been forced to get along without such training. With the tremendous New York improvements of the Pennsylvania and other extensions all along the line there is the increasing need for operating men and engineers of experience and judgment. New positions of responsibility are being created and must be filled. Every year the Pennsylvania has been receiving applications for employment from about twenty college men, most of them graduates of technical institutions. The company is taking steps to get applications from a much larger number. This is true also of every other great industrial corporation in the country.

PHILIPPINE TELEGRAPHERS.—It is reliably reported from Manila that Governor-General Smith has signified his readiness to accede to the request of the Filipino telegraphists for employment. There are at present in the city and in the islands about 100 men formerly employed as telegraphists under the Spanish Government. An efficient telegraph system was one of the boasts of the former régime. Many of the most intelligent men were prompted by their political affiliations to take up arms against Spain. The matter of the apparent neglect of these men was brought up by Senor Pedro de Jesus, for many years a telegrapher employed by the Government of Spain. Senor de Jesus called on Governor Smith in person and the suggestion was made that the Insular Government, in pursuance of its avowed policy of a gradual extension of a "government of Filipinos aided by Americans" by giving employment to the greatest number of Filipinos possible, might well and without detriment to the public service draw upon this competent corps of ex-telegraphers, many of whom are said to be without employment and reduced to want. Report now has it that the desires and hopes of these men are in a fair way of realization.

TELEGRAPHY IN THE SAHARA.—It is stated that the French Government proposes to connect all its African territory on the Mediterranean by a line across the Desert of Sahara. All the details of the scheme have been worked out. The head of the line will be at Adrar, the little capital of the territory of the oases, 1,200 km. from the coast. Thence to Burrum, on the Niger, the line will traverse about 1,400 km.—one section in Algerian territory up to Timissau, the second, the Sudanese section, up to the French post on the river. Six small posts will be established. In a central redoubt, surrounded by outer defences, provisions will be stored for three months round a cistern. Hand grenades will form the artillery. A garrison of five men will inspect the line every two weeks. The posts will communicate daily by telephone, and in case of interruption two men from each post will be detached for repairing the line. From the terminus at Burrum a branch line will run to Timbuctoo, where it will join the Sudanese system serving Senegal, French Guinea and the Ivory Coast. Another line will go eastward to the town of Say, on the river, and join the Dahomey, Zinder and Lake Chad network. The telegraph posts in the Sahara will be metallic and placed at distances of 100 meters, the wires being high enough to allow the passage of a man on camel back.

Shops of the New York Edison Company.

IN street railway work it is common practice for all large companies to maintain extensive repair shops, where motors are overhauled and rewound, cars rebuilt and repainted, and everything else connected with the mechanical side of street railway work, looked after. The character and scope of the work depend on the size of the railway system, the smaller companies contenting themselves with merely looking after the motors, bearings, etc., while some of the larger companies manufacture many of the parts so that in the latter case the repair and maintenance shop is the largest single department of the street railway company. In central station work, on the other hand, repair shops are not at all common, being the exception rather than the rule. Here and there, where a station is remote from cities affording repair facilities, a few tools may be set up because of this fact and small repairs made by the engineer; but seldom is a regular force employed on purely central station repair work, and in very rare instances is a building especially set aside for this purpose.

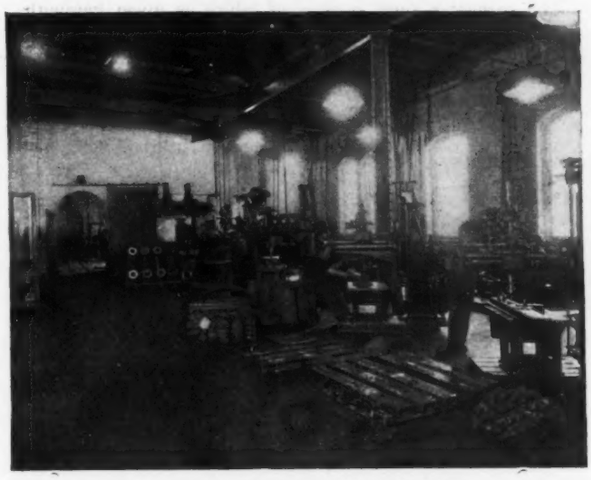


FIG. 1.—ONE END OF MACHINE SHOP.

There are reasons why repair shops are not maintained by smaller companies, the most obvious of which is that it would not pay. With larger companies, however, especially those controlling the lighting of large cities where the system necessitates a number of stations the work warrants the maintenance of a repair shop, if economy in this direction is to be effected.

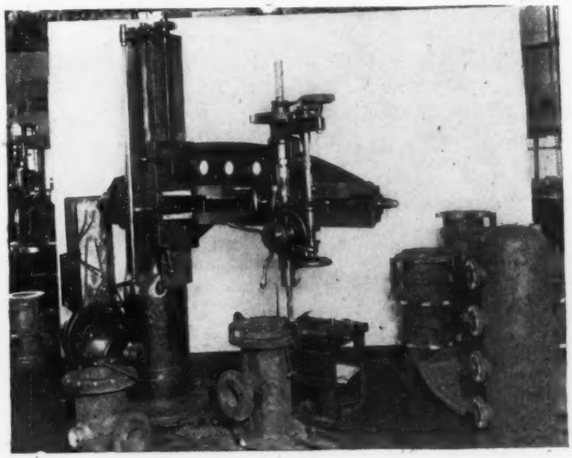


FIG. 2.—4-FT. RADIAL DRILL, DRIVEN BY 3-HP MOTOR.

The shops of the New York Edison Company occupy the block bounded by First Avenue, Forty-first Street, Forty-second Street and the East River. Here are located a machine shop, a blacksmith shop, structural shop, sheet iron and tinsmith shop, carpenter shop, pipe shop, armature repair shop and paint shop, besides the garage for the automobile department and lamp storage buildings. All told there are one hundred and fifty-seven skilled workmen regularly employed in the eight shops mentioned. The character of the work embraces everything connected with the mechanical side of central station work that is within the scope of the machinery provided in the shops. Needless to state the entire shops are electrically-driven.

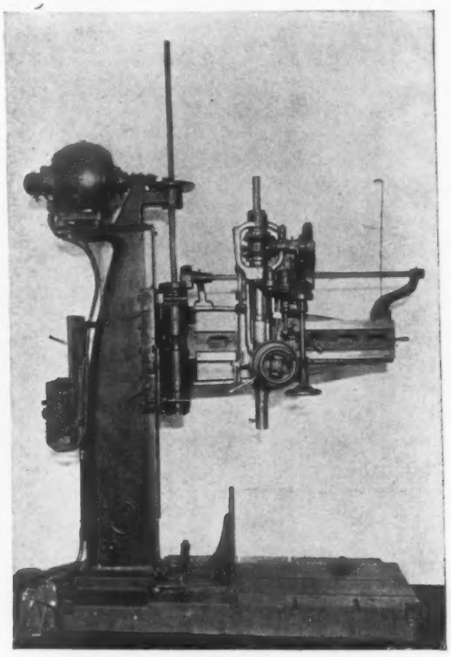


FIG. 3.—4-FT. RADIAL DRILL, DRIVEN BY 3-HP MOTOR.

In the machine shop, partial views of which are given in Figs. 1 and 8, there are forty men employed. The equipment consists of three shapers ranging from 16 in. to 28 ins.; eight lathes ranging in size from 14 in. to 45 in. swing; two 2-ft. turret lathes and one 3-ft. turret lathe; a 36-in. planer, a 54-in. boring mill, a No. 3 Universal milling machine, a 20-in. power punch, two 4-ft. radial drills, two 2½-ft. radial drills, one 20-in. upright and one 14-in. sensitive drill, speed lathe, tool grinder, arbor presses, etc. In the tool room in the gallery of this shop are two 14-in. tool room lathes, one No. 3 Universal milling machine, two Universal grinders, one cold saw grinding machine, twist drill grinder, sensitive drill, gas hardening furnace, etc. The machines were originally driven from a line shaft and were afterwards converted to individual drive. About one-

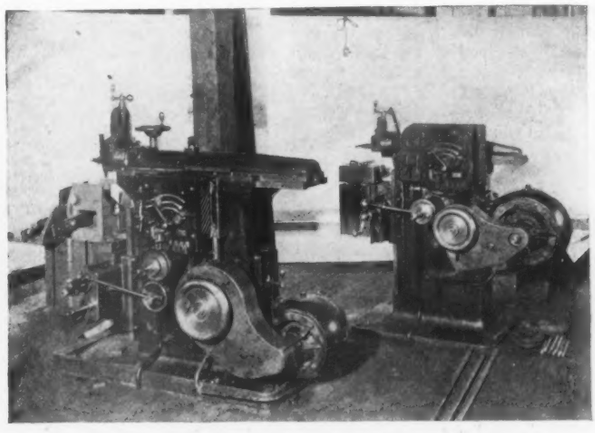


FIG. 4.—18-IN. AND 20-IN. SHAPERS, DRIVEN BY 2-HP MOTORS.

half of the present equipment consists of these converted tools, the other half being made up with motor-driven tools purchased subsequently when increasing work necessitated the installation of additional machinery. In this shop repairs are made to engines, pumps, rotaries, boosters, compensators, bearings, and motors. Bus bars are cut to size and punched, armature shafts

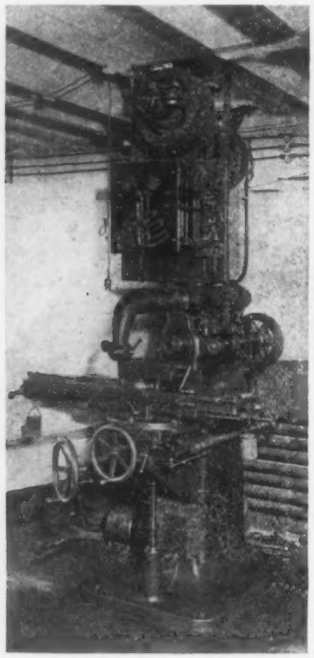


FIG. 5.—MILLING MACHINE, DRIVEN BY 2-HP MOTOR.

are made, commutators are turned down, piping and fittings for boilers are repaired, and in fact everything requiring repairs which comes within the capacity of the shop is sent here, although some repairs are made in the room set aside for that purpose in the Waterside station.

In the blacksmith shop there are seven forges continually at work, besides trip hammers, drop hammers, and the usual blacksmith shop equipment. Pipe hangers consisting of beam clamp pipe clamp and turn-buckle, are made here in large quantities. Hoes, rakes, etc., for the boiler rooms of the various stations are turned out, forgings for automobile repairs, picks and bars for underground work, forgings for structural iron work and

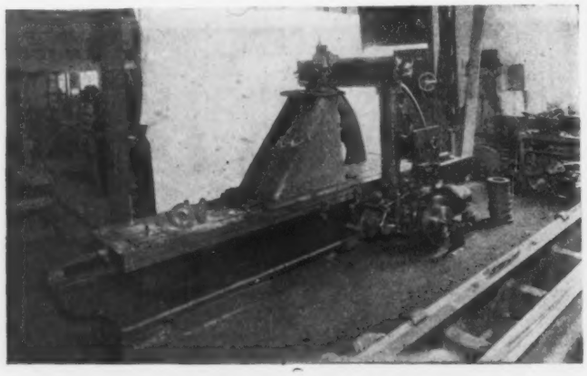


FIG. 6.—36-IN. PLANER, DRIVEN BY 5-HP MOTOR.

pipe bends for underground conduit work. In the structural shop switchboard frames are set up, transformer platforms built, and work also performed in connection with the blacksmith and pipe shops. The equipment in the structural shop comprises a heavy power punch and shears, two cold saws, a 3-ft. radial drill, two 24-in. upright drills, a double head bolt cutter, a metal band saw, a machine for cutting bar iron and angle iron, a compression riveter and pneumatic tools supplied with air from a direct-connected motor-driven air compressor. In both of these shops there are 30 men employed.

In the sheet iron and tinsmith shop, ventilating ducts, tool lockers, shelves, oil cans, filters and guards are made. The equipment consists of square shears, cornice break, upright drill, power punch, angle-iron cutter, shears, power rolls, buffing wheels, circular shears and beader besides the usual hand machines. Thirty men are employed in this shop and all repairs to the buildings and equipment appertaining to tinsmith work is attended to by this department.

The carpenter shop, a view of which is given herewith, is situated in the Forty-first Street corner. Here twenty-five men are regularly employed and the work includes the building of

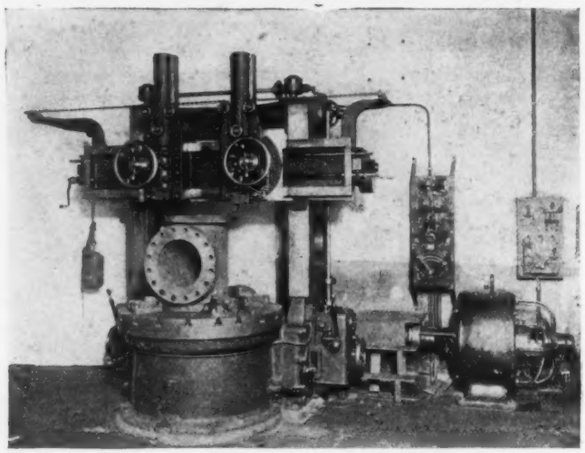


FIG. 7.—53-IN. BORING MILL, DRIVEN BY 15-HP MOTOR.

meter boards, ladders for trimmers, filing cabinets, flat desks, letter trays, frames and doors for oil switches, repairs to buildings, office furniture and general carpenter work. The shop contains a 24-in. planer, a buzz planer, buzz saw, variety machine, band saw, wood turning lathe, cutting-off saw, mortising machine, etc.

Pipe for all purposes including steam and conduit piping is cut to size and threaded in the pipe shop where five men are

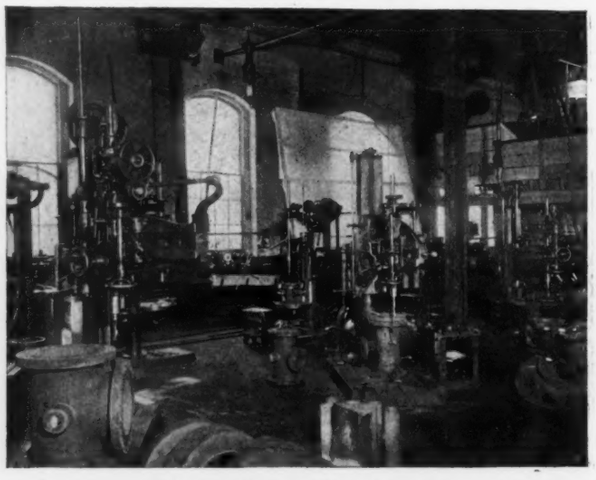


FIG. 8.—CORNER OF MACHINE SHOP.

constantly employed. The equipment includes a 12-in. pipe machine, two 4-in. pipe machines and a pipe bending machine. Temporary supports for arc lamps are also made in this shop. In the armature repair shop where twelve men are employed, armatures and field coils are rewound and reinsulated and other repairs of an electrical nature are attended to. The armature department is equipped with a small lathe and winding machine together with a direct-connected motor-driven air com-

pressor for cleaning armatures, etc. There are fifteen painters employed in the paint shop who attend to the painting of buildings, machinery, etc. The arc lamp department has also a num-

FIG. 9.—MILLING MACHINE, DRIVEN BY 4-HP MOTOR.

ber of painters who devote their time exclusively to painting the arc lamp posts throughout the city.

The entire motor equipment is made up of 220-volt, direct-

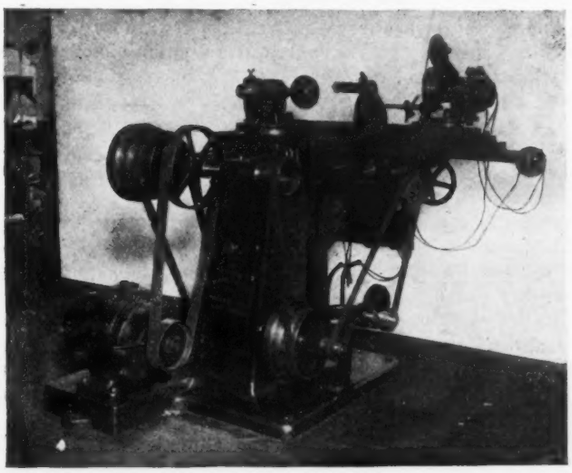


FIG. 10.—MOTOR-DRIVEN GRINDER.

current motors fed from the Edison system. The wiring for the most part is run in conduit. The connected motor load in the shop is 300 kilowatts and the 73 motors installed range in size from ¼-hp to 20-hp. Views are given herewith of many

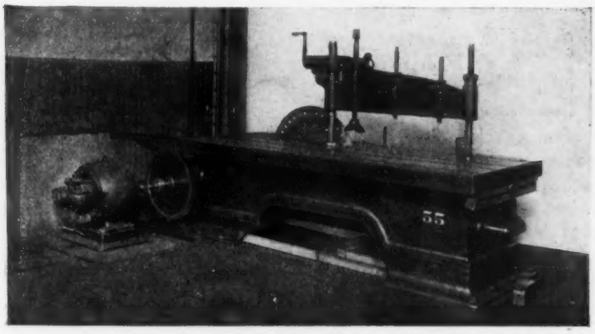


FIG. 11.—31-IN. SAW, DRIVEN BY 7½-HP MOTOR.

of the motor applications. Fig. 1 shows the southwest corner of the machine shop, the tools here consisting of radial drills and boring mills. This view also shows some of the work that is done and the mounting of the various motors. Copper cable terminals, parts of arc lamps, coal downtake pipes, and cast

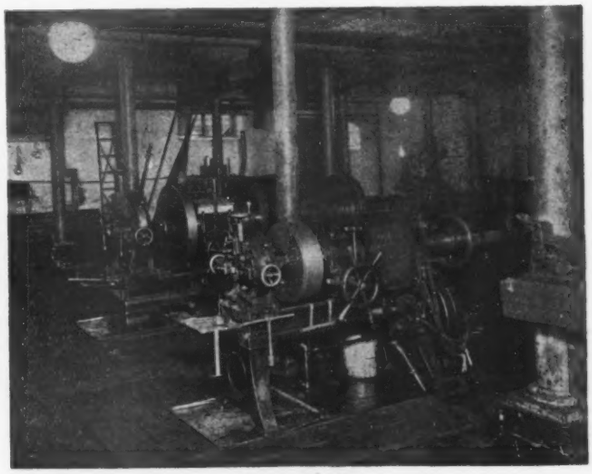


FIG. 12.—ELECTRICALLY DRIVEN PIPE MACHINES.

steel fittings for steam pipe work are shown piled on the floor. Fig. 2 shows a 4-ft. radial drill driven by a three horse-power

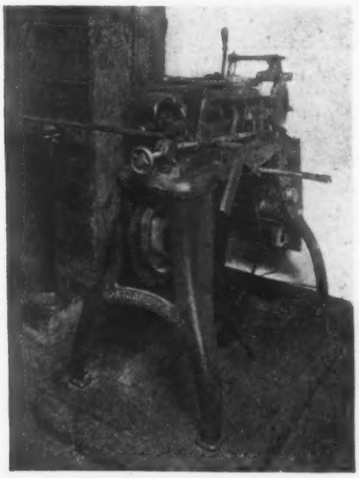


FIG. 14.—HACK SAW DRIVEN BY ½-HP MOTOR.

variable speed motor. The latter is mounted on the bottom of the column in place of the cone pulley. This machine is used

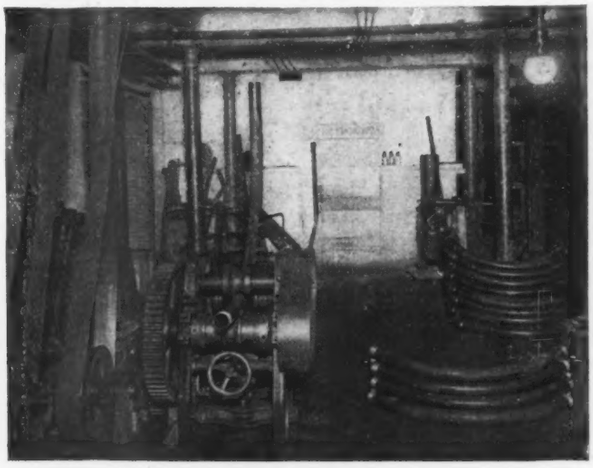


FIG. 13.—PIPE-BENDING MACHINE, DRIVEN BY 5-HP MOTOR.

for general repair work and is shown drilling tees for steam pipe work, coal valve bodies being shown to the right. The starting box is mounted on the back of the machine.

Fig. 3 shows another radial drill of the same size only that in this case the motor is mounted on the top of the column and occupies the space formerly taken by the cone pulley. This machine is also driven by a 3-hp variable speed motor. In Fig. 4 are shown an 18-in. and a 20-in. shaper. Both of these machines are used for general repair work and each is driven by a 2-hp variable speed motor. In both applications the motor is bolted to the back of the shaper and geared to the cone shaft as shown; the gears being encased. The hand wheel shown is

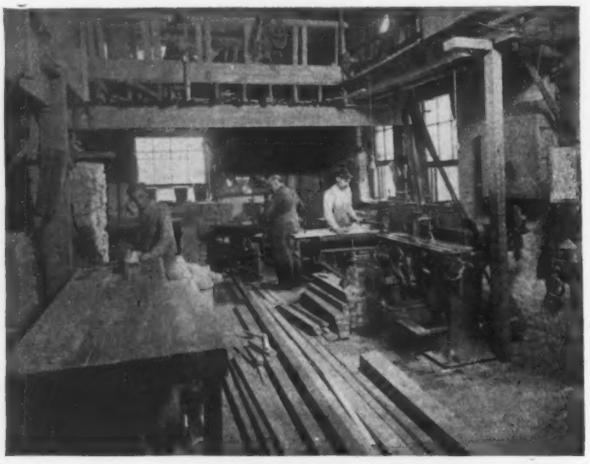


FIG. 15.—CARPENTER SHOP.

for the purpose of moving the ram. The motor driving the milling machine shown in Fig. 5 is attached to the ceiling and is connected to the countershaft by gears taking the place of the tight and loose pulleys. The switches and speed regulator are mounted on a slate board above the machine as shown.

Fig. 6 shows a 36-in. by 12-ft. planer at work on one end of an ash hopper. The machine is driven by a 5-hp variable speed motor which runs continuously and drives the planer by means

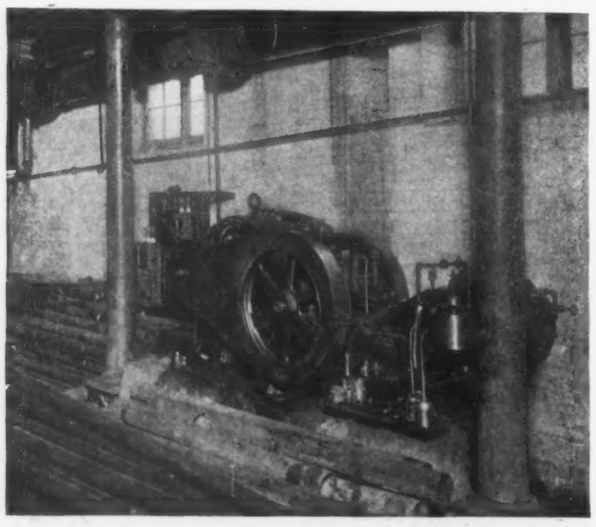


FIG. 16.—AIR COMPRESSOR, DRIVEN BY 7½-HP MOTOR.

of a reciprocating magnetic clutch mechanism. Fig. 7 shows a 53-in. boring mill facing a 14-in. tee for use on a main steam pipe line. This machine is driven by a 15-hp variable speed motor which runs continuously and drives the machine by means of a magnetic clutch which is controlled by push buttons on both sides of the mill. The use of a magnetic clutch drive with this form of control enables the operator to promptly start and stop the mill from any point, and, of course, avoids all belting. The cross rail is raised and lowered by a small motor mounted at the top of one of the housings. The switches, etc., for both motors are on one board. Fig. 8 shows a view of the northwest corner of the machine shop. Fig. 9 shows a No. 3 Universal milling machine driven by a 4-hp variable speed motor. In this case a silent chain drive is employed, the motor, drive, etc., being entirely encased as shown.

The grinder shown in Fig. 10 is driven by a 1½-hp motor, while a ½-hp motor drives the work. High speed is obtained by means of belt drive. A very neat motor application is shown in Fig. 11. This illustrates a 31-in. cold saw driven by a 7½-hp motor, the latter being geared to a wheel taking the place of the usual tight and loose pulley.

Figs. 12 and 13 show two views in the pipe shop. The former shows a 4-in. and a 12-in. pipe machine, the smaller machine being driven by a 5-hp variable speed motor as shown and the larger machine by an 8-hp motor. Fig. 13 shows a pipe bending machine at work on cable bends. This machine is driven through belting by a 5-hp motor. A motor-driven hack saw is shown in Fig. 14. This motor has a capacity of ½-hp and drives the saw through worm gearing. Views of the carpenter shop and also of the air compressor which supplies the compressed air for all the shops is shown in Figs. 15 and 16, respectively. In the former all the machines are driven by motors fastened either on the ceiling overhead or on the ceiling immediately below. The air compressor is driven by a 7½-hp motor.

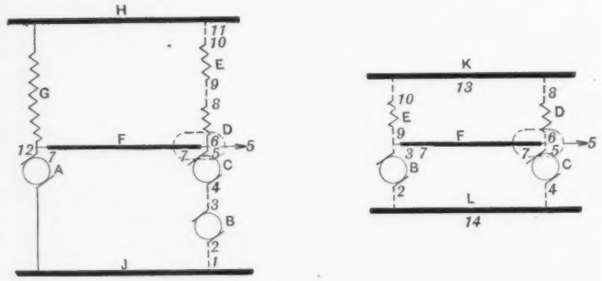
A General Solution of Change-Over Switch Problems.

By Frank M. Denton.

A problem frequently encountered in switchboard design work is that of changing over from one diagram of connections to another, by means of throw-over switches, using the smallest possible number of blades and contacts.

The following is suggested as a practical general solution of the problem: Draw out the two diagrams of connections. Give to each piece of apparatus a letter, lettering corresponding pieces in the two diagrams similarly. Break up all the junctions in each diagram, and give a number to each loose end, taking care that corresponding loose ends in the two diagrams bear the same number. (The letters help to do this speedily.)

When two or more adjacent loose ends in the first diagram are also adjacent in the second diagram, let these ends be grouped together under only one number. Write out in a horizontal row all the numbers that have been used, making a circle round each. (See Fig. 3.) Considering the first diagram, note what loose ends are adjacent to the end marked "1"



FIGS. 1 AND 2.—DIAGRAM OF ELECTRICAL CONNECTIONS.

and set down their numbers around the upper half of the circle enclosing the figure "1." Do the same for all numbers in the row.

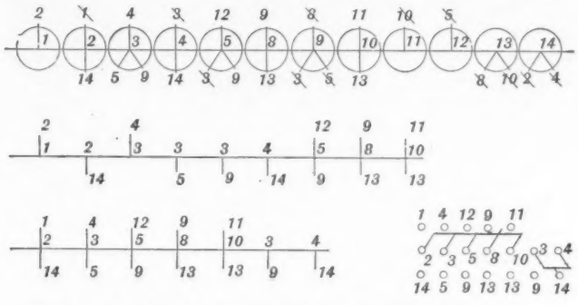
Considering the second diagram, make similar use of the lower semicircles. Draw radii from the centers, to each of the numbers on the semicircles, and designating each radius by the numbers at its ends, cross out all duplicate radii, first in the upper and then in the lower semicircles. Then each radius in the upper semicircles will represent one blade of the first throw, and each radius in the lower semicircles will represent one blade of the second throw of the required switches.

And the numbers at once indicate the required wiring, each pair of similar numbers (not in the same throw) indicating a loose end joined to a hinge clip, and other numbers in the upper and lower semicircles indicating loose ends joined respectively to upper and lower clips.

The following example makes the method clear:

A 500-volt compound-wound direct-current generator is working in parallel with two 250-volt compound-wound direct-current generators joined in series. It is required, by one throw of as few switches as possible, to change over so that the 500-volt machine remains upon the buses, whilst the two 250-volt machines are thrown into parallel with one another across another pair of buses. The same equalizer bus is to be used in each case.

Figs. 1 and 2 show the two diagrams of connections, *A* and *G* being respectively the armature and the series field coils of the 500-volt machine, and *B* and *E*, *C* and *D* those respectively of



FIGS. 3, 4, 5 AND 6.—SOLUTION OF CHANGE-OVER PROBLEM.

the two 250-volt machines. (Shunt field coils are omitted for simplicity in the diagrams.)

The junctions are broken at the dotted lines, and the loose ends are properly numbered.

The ends 5, 6, 7, being adjacent in the two diagrams, are grouped together and called 5.

In Fig. 3 all of the numbers used are set in a row, and on circles drawn round them are put the numbers of the adjacent ends. Radii are drawn and duplicates cancelled as shown.

Fig. 4 shows all the blades of both throws of the required switches.

In Fig. 5 the hinge clips are determined by placing together similarly numbered blade ends, and the solution of the problem is at once evident, as shown in Fig. 6. The smallest possible number of switches that can be used is five double-throw and two single-throw switches. These must be grouped to suit conditions.

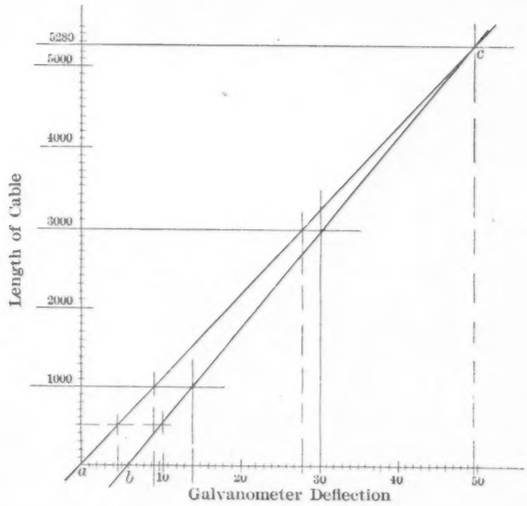
Measurement of Wire and Cable Insulation.

BY F. WACHTER.

Every one familiar with the manufacture or use of insulated wire and cables knows the expression "megohms per mile." The insulation of a length of wire, say, 500 feet, is tested for dielectric resistance by comparison with a known resistance by means of the familiar direct-deflection (galvanometer) method, and it is assumed that the insulation resistance varies inversely with the length, because the conductivity of the dielectric is evidently directly proportional to the cross section, which varies directly with the length. Although the proportionality between the conductivity and the length is correct, it does not follow that the galvanometer deflections obtained from 500 feet and from one mile of wire, applying the same voltage in each case, follow a direct ratio.

Distributed throughout the dielectric are minute particles or pores which form paths of relatively high conductivity for the current when the electromotive force is greater than a certain value. These particles or pores are of various sizes and shapes, and all of them have not the same resistances. There are evidently more leakage paths in a long piece of wire than in a short one. Since a drop in the electromotive force accompanies a flow of the leakage current, the terminal e.m.f. will be less than the impressed e.m.f. and it may be much less for a great length of wire than for a short piece. The dielectric strength of some of these particles or pores is large enough to withstand any electromotive force lower than the impressed value. It follows, therefore, that in a long piece of wire some of the leakage paths allow current to pass, while others towards the extreme end of the wire may not be subjected to sufficient e. m. f. to cause current to flow.

Assume, for illustration, that a coil of wire 3000 feet long gives a galvanometer deflection which indicates an insulation resistance of approximately 852 megohms per mile. When this coil is divided into three equal parts, and the parts are separately tested. it will seldom be found that the galvanometer deflections will be the same for all coils, but their average should indicate an insulation resistance of 852 megohms per mile. Such is not the case, however, because the actual deflections will show a value of approximately 608 megohms per mile. A coil of the same wire 500 feet long will show an apparent insulation resistance of 387 meghoms per mile, while a test of a continuous mile of the wire would show an insulation resistance of 932 megohms, which obviously is the correct value when the mile is taken as the unit. In the accompanying illustration, in which the vertical scale represents the length of the wire and the horizontal the galvanometer deflections, the line *ac* shows the deflections which should be obtained if they were always proportional



TEST OF CABLE INSULATION.

to the length. The line *bc* indicates the deflections actually observed in the particular case chosen.

The divergence between the observed values and the correct values varies with different kinds of insulating compound. It might be stated that the more nearly the lines *ac* and *bc* coincide the better the insulating compound. As indicated by the diagram, their error is larger in a short piece of wire than in a long one; hence a short length of wire should not be selected for testing purposes.

The significance of the above results will be appreciated when it is known that a manufacturer who accepts an order for insulated wire to be delivered in 500-feet coils, each of which is to have an insulation equivalent to 500 megohms per mile, must use a higher grade of material than the manufacturer who is required to supply the wire in 1000-feet lengths, having an insulation resistance of 500 megohms per mile.

There are two possible methods of arriving at the correct insulation resistance per mile of a certain wire or cable. One of these is to test a full mile of the wire, and the other is to take readings on two or more different lengths and then proceed according to the method outlined below. Referring now to the accompanying illustration, assume, for instance, that for a wire 3000 feet long there is obtained a galvanometer deflection

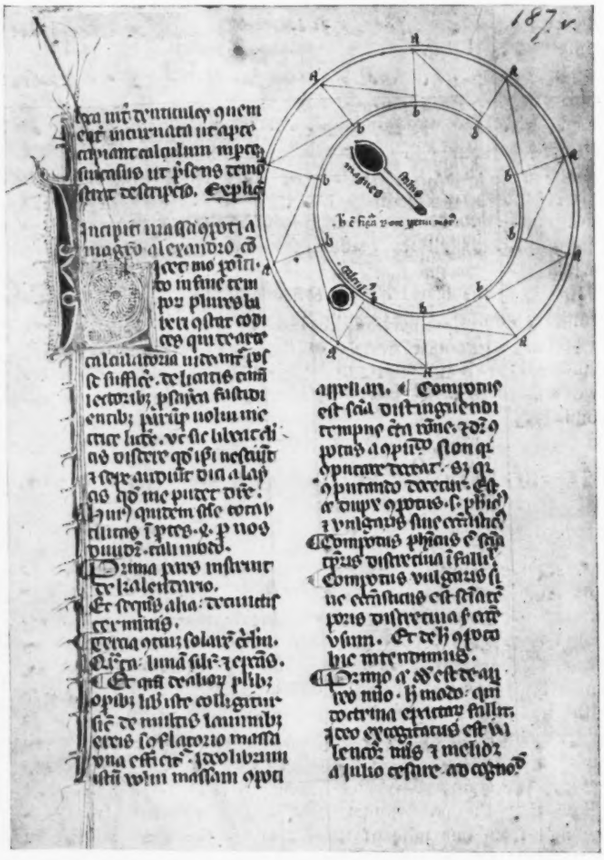
of 30 divisions, and from a piece of the same wire 1000 feet long the deflection is 14 divisions. It will be noted that a change of 2000 feet in the length of the wire made a difference of 16 in the deflections, so that by direct proportionality it is found that a change of 4280 feet would make a difference of 34.24 divisions, and a total deflection of 48.24 divisions would be obtained for 5280 feet, or one mile, of the wire. A similar method can be employed for other lengths or other observed deflections. The problem can also be solved most readily by means of a graphical diagram similar to that shown herewith.

Petrus Perigrinus, the Earliest of Magneticians.

By Brother Potamian, D.Sc., Lond.,

Prof. of Physics in Manhattan College.

The interest taken in Peregrinus, the thirteenth century soldier and physicist, has continued to excite the activity of scholars from the appearance of Bertelli's celebrated memoirs,



Reproductions of Folios of Peregrinus' Epistola.

"Sulla Epistola di Pietro Peregrino di Maricourt"*, in 1868, to the scholarly paper which Prof. Silvanus P. Thompson contributed to *The British Academy* in November, 1906. The interest in the individual is fully justified by the splendid original work which he did at that remote epoch in the unexplored domain of magnetism. Very little was known before he entered the lodestone-field and little of fundamental value was left to be gleaned after him. He was a Frenchman, born at Maricourt in Picardy, whence his name, Pierre de Maricourt; but he was better known to his contemporaries as Pierre le Pelerin, or Peter the Pilgrim (Latinized, Petrus Peregrinus), from his having visited the Holy Land in one of the military expeditions of the time. Later in life, he joined the army of Charles of Anjou when that ruler proceeded to Southern Italy to bring back the revolted city of Lucera to his allegiance; and it was there in the trenches amid warlike preparations and the din of arms that he wrote his famous *Epistola de Magnete*"* finishing it, as he says, on the eighth day of August, A. D., 1269.

The very titles of the thirteen chapters into which the letter is divided show that Peregrinus was thoroughly imbued with the spirit of research, and that he was an out-and-out laboratory man in his methods. Observation and experiment were everything to him, just as they were everything to his Franciscan admirer in the brotherhood of science, Roger Bacon. He discovered nearly all the phenomena of the lodestone, deduced the laws governing them and coined the terms that he needed for description, many of which continue in use at the present day. Throughout this little treatise, he shows uncommon resourcefulness in varying the tests and conditions of experiment that no flaw may go undetected. His aim, however, does not appear to have been to discover the phenomena peculiar to the lodestone so much as to turn his newly acquired knowledge to practical account, and chief of all to the solution of the fascinating problem of perpetual motion. He, indeed, designed a wheel which he thought would go on rotating indefinitely in virtue of the compelling force of magnetic attraction which he introduced into the mechanism with consummate ingenuity. But he also designed something more important

* Library of the American Institute of Electrical Engineers, Wheeler Gift.

and practical than this illusory motor, for he did away with the crude, floating magnet of his time, and gave the sea-faring man the first pivoted compass which the world ever saw. The invention of the mariner's compass has often been attributed to one Flavio Gioja, of Amalfi, near Naples; but, inasmuch as the celebrated Italian pilot did not see the light of day before the year 1300, whilst Peregrinus had sent his epistolary treatise on the magnet to his friend at home in Picardy thirty years before, it follows that Gioja's claim is entirely superseded.

The famous *Epistola* in which these discoveries and inventions are described in about 3500 words was written in Latin, according to the custom of the age. Of the twenty-eight manuscript copies known to be in public libraries or in private collections, Prof. Thompson selected one of the seven in the Bodleian Library, Oxford, for reproduction by photography. From the specimens which are printed herewith (reduced about one-third) of this fine thirteenth-century folio manuscript, it will be seen that it is written in clear, Gothic letters and in two columns of thirty-five lines each. These pages were selected from the copy which Prof. Thompson sent us because of the interest that attaches to the two diagrams, one of which shows the graduated arc of an early compass of Peregrinus with its fiducial line, and the other his magnetic motor on which he set such high esteem.

Of Continental manuscripts, that of the University of Leyden has acquired considerable celebrity because of a paragraph in it relating to magnetic declination; but it has been shown that the lines referring to this magnetic element are spurious, having been interpolated in the MS. sometime in the early part of the sixteenth century. This Leyden MS. was partially published in Latin and in English by Tiberius Cavallo in the third edition of his "Treatise on Magnetism," 1800.*

The Bibliothèque Nationale, of Paris, has also a MS. copy of the *Epistola* which belongs probably to the latter part of the fourteenth century. It is interesting from the fact that it was transcribed by Libri in his "Histoire des Sciences Mathématiques,"* 1838, passages difficult of reading or interpretation being omitted.

The Vatican Library, has four MS. copies of the *Epistola*, one of which belongs to the thirteenth century and is thought to be the oldest extant. Bertelli, a priest of the Barnabite order, collated these manuscripts; and after prolonged study and research, published in 1868 a version* which Prof. Thompson does not hesitate to call the *textus receptus* of the *Epistola*, together with copious notes and references of great bibliographical and historical value.

Just 310 years previous to the appearance of Bertelli's great work, that is in 1558, the first printed edition of the *Epistola** came forth from the presses of the historic city of Augsburg with preface by Achilles Gasser, a scholarly physician of Landau. Only eighteen copies of this edition are known, one of which is in the Wheeler Gift of the Library of the American Institute of Electrical Engineers.

That there were scientific pirates in the sixteenth century is shown by the pages of Taisnier's "De Natura Magnetis,"* 1562, in which whole paragraphs are taken verbatim from the *Epistola* without a word of acknowledgment. Prof. Thompson has had the patience to compare the texts and has pointed out the plagiarisms line for line in his "British Academy" paper.

Of partial translations, we have that which Richard Eden made of Taisnier's work in 1854;* that of Cavallo, 1800,* and that of Libri (French) 1838*. Complete translations of the *Epistola* were made by Prof. Thompson in 1902* and by Brother Arnold, 1904.* The former was printed for private circulation only; the latter was published by the McGraw Publishing Company, New York.

Prof. Thompson does not fail to notice the meritorious effort made by Prof. Charles S. Peirce, of Harvard, in 1892, when he proposed to publish an edition of the *Epistola* based on the Paris parchment manuscript of the Bibliothèque Nationale. A pamphlet of eighteen pages was printed at the time by Mr. De Vinne, eleven of the pages being devoted to introductory matter and two given as specimens of the projected translation; but, unfortunately, the work did not get beyond the incipient stage solely for want of encouragement.

Students of magnetic history, the world over, will welcome this latest Peregrinian contribution by Prof. Thompson to the ever-growing scientific literature of the thirteenth century.

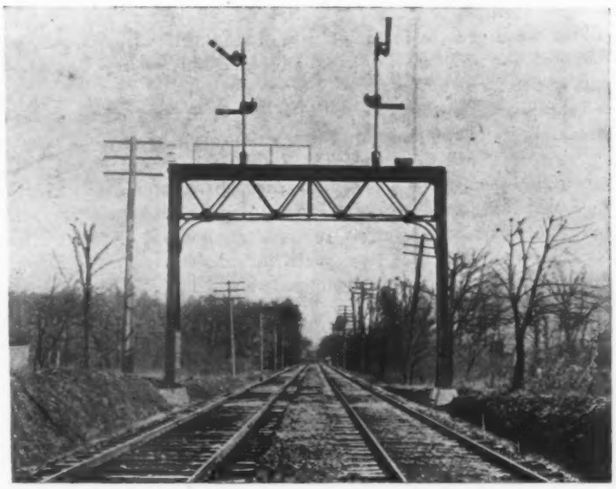
NOTE.

In an appendix to his paper in the *British Academy* of November 28, 1906, Prof. Thompson gives a list of twenty-eight manuscripts of the *Epistola de Magnete* of Peregrinus with remarks on each. The list shows that the University of Leyden has 1; Vatican Library, 4; Bibliotheque Nationale, Paris, 2; Bibliotheque Riccardiana, Florence, 1; Bodleian Library, Oxford, 7; Trinity College, Dublin, 1; Caius College, Cambridge, 1; Bibliotheque Publique, Geneva, 1; University of Turin, 1; Library of S. P. Thompson, 2; University of Erfreot, 3; Imperial Library, Vienna, 3; and British Museum, 1; the total number being 28.

New Signal System on the Pennsylvania Railroad.

Tests have recently been conducted on the Pennsylvania Railroad near Philadelphia of a new system of electropneumatically-controlled signals which has been adopted for use jointly by the Baltimore & Ohio and the Pennsylvania Railroad Companies at the new Washington Terminal.

According to the new system two arms and two lamps will be used on every high signal, as indicated in the accompanying illustration; day indications are given by three positions of the arm, and at night each position is indicated by allowing the light to pass through a different colored lense. The top arm governs the high-speed movements and the second arm governs



STOP, WAIT-TIME AND PROCEED SIGNALS ON BRIDGE.

the medium-speed movements. A centrally-located plant supplies air compressed to 90 pounds per square inch, and electricity at 500 volts. The air is transmitted through a 2.5-in. main and the electricity by a No. 6 copper wire for operating the track circuits, while that for the signals is taken from storage batteries located at the various signals. The batteries are charged in series from the 500-volt supply circuits, eight hours at a time, four nights per week.

The actual work of moving the signals is performed by the compressed air, the electricity being used for opening the air valves as required. The home signals are so interlocked that they go to "stop" subsequent to the passage of a train and they cannot be operated again until the train has passed from the block circuit.

Technical Graduates and Central Stations.

The following interesting contribution by Mr. Henry L. Doherty to the discussion of Prof. Geo. D. Shepardson's article on "Technical Graduates and Central Stations," was dictated early in January, but has been delayed in publication owing to lack of time on the part of the author to correct the transcript, which is here printed as it came from the typewriter.

I have read with some interest the article by Professor Shepardson, entitled "Technical Graduates and Central Stations," and regret that I cannot agree with all the views expressed. Surely I am the last man who would belittle the work of the engineer. On the other hand, I must testify to the value of the man who can get additional business for the company.

Taking the ordinary central station of to-day, it is possible for the man who can develop additional business of the right sort to reduce the total cost of current on a unit basis more than it is possible for the engineer to do. When I say "total cost," I do not mean merely the expenses of operation, but I include all costs, both fixed and operative.

Contrary to Professor Shepardson's views, I do not believe proper credit is given to the "New Business" man. On the other hand, I see no reason why the engineer cannot be made a better "New Business" man than the man without a good knowledge of central station work.

The problems which confront a central station of to-day can be pretty well enumerated under the four following heads, and I attempt to state them in the order of importance which I believe they deserve:

First: The protection of the investment by proper handling of corporate matters and the policy of the company towards the public.

Second: Development of the market.

Third: Production of work energy from heat energy.

Fourth: Electrical engineering.

Stated in a different way, there are three things more important than a knowledge of electrical engineering, any one of which are a greater factor of value than electrical engineering. Most of our problems in electrical engineering are now worked out at the factory.

I cannot agree that the power house equipment of to-day is becoming more complicated. To my mind it is more simple and requires less skill to operate. The old small machines and old apparatus seemed to have individual characteristics of their own, which required a personal acquaintance with each individual machine. Our present apparatus is better built, is of more uniform behavior, requires less special knowledge, and being more rational in design, is less complicated and more easily understood, both by the technician and the ordinary layman.

We took in no less than 20 graduate engineers last year in a single one of our central stations. In our Denver property we now have over 50 graduates of technical schools. Instead of the central station field presenting an unattractive appearance, it presents to my mind a more attractive appearance on close study than other fields in which the graduates might enter. It may not, and probably does not, present as high a salary on the start. While I think the general criticisms passed on young graduates are often erroneous, I do think that one criticism is almost universally applicable, namely, their lack of appreciation of the value of a proper training after they leave college. A good education, backed up by proper training, represents a particularly desirable form of capital. It cannot be unwisely spent or mortgaged. It is the one asset a man does not have to put in his wife's name to insure himself against loss in case of bankruptcy. It can often be made to have an earning power equivalent to $500,000 in cash.

In spite of this immense value which can be acquired by backing a good technical education up with proper training, almost any graduate will sell his opportunity for an advance in salary of $25 per month. I have seen many examples of this. One of these will bear telling.

One of the young engineers in our employ several years ago gave particular evidence of mental capacity and industry. He attracted the attention of others and was offered a position at almost double the salary we were paying him. He laid his offer before me, and I realized that if he were dissuaded from accepting it he would not remain satisfied in our employ. I told him that I believed the offer was an unfortunate thing for him, but nevertheless advised him to accept it. Two years afterwards he came in to call on me where I was located in another State. He commenced to ask about the boys who had been associated with him when he was a cadet engineer. As he asked about first one and then another, I was quite surprised to find how rapidly these men had advanced, and it was an interesting fact that every one of these men had passed him, both in point of compensation and in future prospects. He was practically in the same position as when he had left us two years before. This was through no particular fault of his. His employers had hired him to do certain work. They had paid him all they thought he was worth. If they had any interest in his future, it was to keep him in his present position. There was no natural line of advancement to carry him on to better things, or, rather, what was pointed out to him as a natural line proved to be a path of such high resistance that it would have taken a very extraordinary man to have overcome the difficulties in his way.

The young engineer should strive first for opportunity. A joke occasionally contains food for thought. I recall one old stage joke. The speaker said: "There is plenty of room at the top of the ladder, but that don't interest me much as long as the bottom rungs of the ladder are so badly crowded that I cannot get a start."

The average employer is very near-sighted in his ideas of economy and the young engineer is near-sighted in his ideas of thrift. The employer wants to put the young engineer where he will earn the most money for him each day. He is not willing to lose any of the attractiveness of the young engineer's labor for the sake of fitting him for better things and to enable the young engineer to fill positions of vast importance where the profit to the employer by good labor on the part of the engineer represents hundreds of dollars each month rather than twenty or twenty-five dollars per month. The young engineer, on the other hand, is not willing to accept a small salary for a reasonable period of time to enable him to acquire a proper training. These two conditions taken together handicap the progress and the importance of the technical graduate in the world of affairs.

I think we often learn more by thinking than we do by studying, but change of scene, change of work, and encouragement on the part of the employer, are the incentives which maintain interest and develop a thinking man in the young engineer.

It is not my experience that the young graduate thinks he knows it all. In fact, he is, as a rule, very modest, and often helpless. He is more apt to be guided by prevailing bad practice than by analytic thought. He does not always clearly appreciate the fact that the world of industry demands men who can do things rather than men who simply know how to do things.

I always like to have my men view their work from the standpoint of what they would do if they owned the property, or if they were the chief executive officer. I want them to believe that they are the ones who are primarily responsible.

I am a firm believer in the value of a technical education, but I sometimes think it robs a man of his individuality and originality. We are casting all of our men in practically the same mental mold.

Statistics are not very accurate, and hasty conclusions drawn from them are apt to be erroneous. In one of my public addresses I called attention to the fact that of the men appearing in the directory of "Who's Who In America," the great bulk of these men had been given a higher education, in spite of the fact that only 2-2/10 per cent. of the males over 30 years old in this country had been given such an education. The figures were startling, but there was one fact which was apt to be overlooked, and that fact is this: Of the boys who have an opportunity to get a higher education many of them have parents, relatives or friends who can push them to the front.

Opportunity is a great factor in the progress of every successful man. It is my opinion that there are many relatively better men at the bottom than there are men at the top. Success often breeds success. Many a man has been pocketed well down the ladder by being behind one, two or three incompetent men who were incapable of achievement. Other men have secured rapid advancement on account of the superiority of the man just ahead of them in rank. As their superior has been called to a higher position they have naturally followed him up. Interest on the part of a chief engineer or superintendent will often place the poorer of a number of graduate engineers in line for advancement. The help the superintendent or chief engineer can give him, and the fact that the superintendent or chief engineer has a voice at court, will do much for the advancement of the young engineer.

I have almost entirely overlooked one of the greatest factors in the young engineer's progress, and that is, ability to get along with other men. Harmony is the first consideration in the operation of all organizations, and especially true in industrial organizations. A happy disposition and a pleasing way will not only do much to win good will, but it often brings dollars and cents results; or, on the other hand, an ugly disposition will do much to destroy the esprit de corps and the effectiveness of production of an entire organization.

As a rule, all incompetent men are dissatisfied men. The man who cannot "deliver the goods" is always explaining that some one else had a better opportunity. He wastes his energy, that might be devoted to securing real results, in convincing himself and others why he does not get results. While all poor men are not dissatisfied men, and all dissatisfied men poor men, yet as a rule the two classes fit pretty well, and in taking hold of a new organization, without time to carefully weed out the poor ones, the new manager is pretty safe in just cleaning out all of the dissatisfied men around the place. He will be pretty apt to get 90 per cent. of the poor men.

The young engineer who complains about not having equal opportunities, if he ever does reach a position of importance, learns that it is a peculiar fact that almost every man who is a poor workman always tells him the same tale. And many of these men must have looked back with some sense of embarrassment regarding their own complaints.

The technician and the professional educator are all deserving of more or less criticism, but chiefly on the score that they do not establish closer and more intimate relations. These closer relations I think would result in profit to all. One of my chief efforts in various association work was to bring together the practical man and the professional educator. Neither seemed to have any very particular desire for close acquaintanceship, and my associates in association matters have generally opposed —and in some cases effectually—my attempts to compel these two classes to mix.

Through my efforts professional educators were for a time admitted to the National Electric Light Association as active members, and on terms commensurate with their income. At practically my first absence from the convention this plan was changed. I am sorry I was not there to protest. On the other hand, neither class showed any great interest in the conditions I had tried to establish, and on the theory that the majority is right, I must have been wrong.

The practical man is very fond of criticizing the professional educator and the technical graduate. In the various industrial plants with which I have been connected it would be hard for me to say whether the practical man has profited most by association with the technical graduate or whether the technical graduate has profited most by the association with the practical operator. I believe the practical operator has had the best of it. He has secured more efficiency from the knowledge secured from the technical graduate than the technical graduate has gained in efficiency from what he has learned from the practical operator. Men become practical if they have to do things, but technical education is not so easily acquired from necessity.

It is my opinion that the professional educator and the technical graduate have not been given a fair chance. It is also my opinion that the practical operator and the man of affairs have more to gain by cultivating this class than the professional educator and the technical graduate may gain by cultivating the man of affairs and the operator.

As tax-payers we spend vast sums for education. A great deal of this is applied to higher education. If the men who are so free with criticisms of our methods of education are really qualified to speak with so much assurance, they should be willing to devote the time that they now give to destructive criticism to specific recommendations or to constructive criticism.

It is sometimes a temptation to me to criticize our present educational methods, and I have often been guilty of doing so. On the whole, however, I have tried to guide my interference in these matters with good intentions. I am glad to see this matter being taken up by the ELECTRICAL WORLD. I wish it could be given extended consideration.

There is a society known as "The Society For The Promotion Of Engineering Education." Professor Jackson is the president of this society this year. Professor Jackson was a practical engineer before he became a professional educator, and has always kept in close touch with practical men. Through the medium of this society the practical operator could do much towards shaping engineering education, and the society could also do much in making the practical operator understand the functions of the university. This society offers a common meeting ground for the exchange of ideas, and having usurped an important field of work, it should put this work on the high plane which it deserves.

The training of the young engineer is a work in which I take much interest. Some of my views are perhaps rather decided. I do not feel that I know all about this subject, but I do feel I know something about it. Hardly a week passes but that I am asked for an interview on some subject or other, but I feel like saying to most of my questioners what I once said to one of them: "I do not carry around opinions, but form them." The formation of correct opinions require much time and thought. My every-day work demands all of my time and mental energy. I have broken my usual rule on account of my interest in this subject. The above is simply a hurried dictation, and is in the nature of thinking out loud.

Recent Electrochemical Developments.

ELECTRIC FURNACE PROCESSES.

While in Europe the calcium carbide industry is in the hands of a great many manufacturers, competing with each other with resulting low prices, the Union Carbide Company with works at Niagara Falls and Sault Ste. Marie practically enjoy a monopoly in this country. The only competition they ever have met, has been from a small plant of Mr. H. L. Hartenstein, at Constantine, Mich. The product of this plant has been sold as carbolite. A larger plant for the manufacture of the same product is now in course of erection at Duluth, Minn.

A recent patent of Mr. Hartenstein is interesting, since its object is the production of a high-grade carbide from a cheap raw material which is found in many places in the United States. It is known as "marl" and occurs in the form of a pulverulent lightly coherent earth or mud, and is ordinarily found in beds in swampy places and comprises from 20 to 50 per cent of water. The native marl ordinarily contains from 95 to 98 per cent pure calcium carbonate and is therefore suitable for carbide manufacture. It is dried and calcined, and the resulting hot oxide of lime is mixed with coke which has been preheated by the waste gases from the calcining furnace. The hot mixture is then treated in an electric furnace for the production of carbide in the ordinary way. It will be interesting in future to watch Mr. Hartenstein's commerical work in this field.

The electrometallurgy of zinc was recently the subject of an interesting paper of Mr. Woolsey McA. Johnson, before the

New York Section of the American Electrochemical Society. While for the full contents of the paper the reader must be referred to the March issue of *Electrochemical and Metallurgical Industry*, we notice here only a few remarks on the application of the electric furnace in the zinc industry. As Mr. Johnson points out, the problem is very attractive. With reasonably cheap waterpower supplying the electric equipment, capital invested per unit of zinc produced will be small, because a continuously-working electric furnace will put through an enormous tonnage per cubic foot of active space. Large units can be employed instead of the small ones in the present retort process. The labor charge will be low, the metal recovery will be high and the zinc produced will be pure. The chief trouble is, according to Mr. Johnson, the condensation of the zinc vapor on a large scale to metallic zinc and not to zinc dust or blue powder. When the proper method for maintaining the correct temperature relations on a large scale has once been discovered the problem will, of course, be solved.

In this connection a recent patent of Mr. Edward R. Taylor for a continuously-working zinc furnace should be mentioned. Mr. Taylor is well known as manufacturer of carbon bisulphide by means of his continuously-working electric resistance furnace process. His electric zinc furnace, as described in the patent, is in many respects similar to his carbon-bisulphide furnace and is certainly well designed to give a high thermal efficiency. How far the above-mentioned difficulty of getting metallic zinc has been solved, must be found out by practical experience.

New Telephone Patents.

NEW TRANSMITTER.

Practically all granular button transmitters have been heretofore filled with angular granules with sharp, clean corners. Messrs. K. M. Turner and N. W. Johnson, of New York, have now patented a transmitter filled with granules approximating spheres in shape, these being of small diameter. This sort of filling is very mobile. In their transmitter the carbon diaphragm is opposed to the vertical face of a carbon block with several surface depressions. These are two-thirds filled with the round grandules. The patent for this transmitter is assigned to the General Acoustic Company.

BUSY LINE INDICATOR.

A busy line indicator for party lines forms the subject of a patent granted to I. Kitsee, of Philadelphia. This indicator comprises a vane operated by an electromagnet, one indicator being placed at each station. The coil is wound to many thousand ohms resistance, so that even though one be bridged across the line at each station, not enough current will pass to operate the line relay at the central. At this time all vanes show clear. The removal of any receiver so shunts out the coils of the indicator that all release their vanes.

TRUNK CIRCUIT.

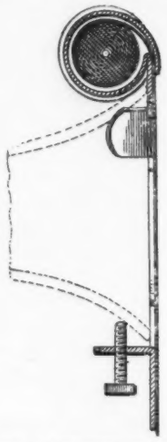
F. W. Dunbar has invented and patented a trunk-circuit of the one-way type. This circuit is designed outgoing at a common battery switchboard of the two-wire type and incoming at a magneto switchboard. The novelty lies in the arrangement of busy test with a low-resistance relay, and low-voltage test battery and improvement in the control of the signals. The patent is assigned to the Kellogg Company.

THROUGH SIGNAL.

A through signal by means of which one subscriber may call back a distant one through, but without the assistance of the exchange, is patented by W. R. Whitehouse, of Bethlehem, Pa. The system is for use where one subscriber lays down his receiver and leaves the correspondent waiting. Now, if the latter tires, by vibrating his hook, he operates a quick-acting magnet which through a bellows pump closes a howler circuit toward the distant line. This calls back the subscriber through the noise from the receiver. The flashing does not call in the operator, as her signal controlling relay is damped so as not to follow a momentary current.

ANTISEPTIC DEVICE.

We recently noted an antiseptic device wherein a roll of paper is maintained in a roll-holder formed by rolling back the top of the face plate. Another and similar scheme is



MACGILL MOUTHPIECE GUARD.

patented by R. R. Macgill, of Baltimore. He has a face plate with clamp guide and aperture, but the roll-holder is formed by bending forward curl at the top of the plate, the receptacle thus formed being pushed back so that the paper shield is delivered in front of the plate instead of behind it. The device is shown in the figure in section.

Letter to the Editors.

Electrolytic Lightning Arrester.

To the Editors of Electrical World:

Sirs: In the December (1906) issue of the *Proceedings* of the American Institute of Electrical Engineers there appears an interesting paper by Mr. R. P. Jackson on "Recent Investigations of Lightning Protective Apparatus," in which a preliminary notice of an "Electrolytic Lightning Arrester" is given. In the paper this electrolytic arrester is claimed as a new invention. As, however, the identical apparatus was invented in this country in the year 1901, its recent rediscovery in America interests me, and I have thought that an account of some experiments carried out by the present writer in 1901 would be of interest to your readers.

The invention in question was embodied in Mr. S. Z. de Ferranti's English patent No. 25,426 of 1901, claims 1, 2, 5 and 6 of which read as follows:

"(1) In the control of electric circuits, the combination of electric resistances having the property of building up resistance under a certain critical voltage, and breaking down in resistance above that voltage, with switches, substantially in the manner and for the purpose described.

"(2) In the control of electric circuits, as claimed in claim 1, resistance consisting of cells having aluminum or chromium electrodes in combination with a suitable electrolyte.

"(5) In electric circuits, the combination of resistances as described in Claim 1, with an air-gap to form a Lightning Arrester or static potential discharge, substantially as described.

"(6) In electric circuits, the use of resistances as described in Claim 1, as safety resistances directly connected across the mains or from one main to earth, substantially as described."

In the body of the patent the invention is described as follows:

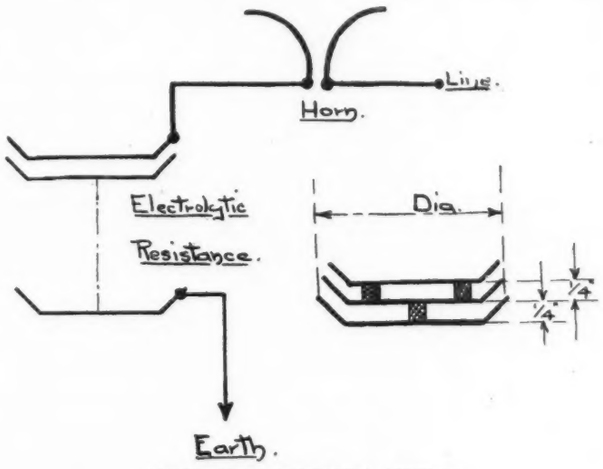
"My invention is also applicable in connection with lightning arresters for protecting lighting or power circuits. In this case I couple a suitable number of cells in series with the air-gap of

the lightning arrester, a sufficient number being employed so that the sum of their critical voltages will be above the potential of the circuit to be protected. Should an arc then be established, the cells would permit current to flow due to the high potential and frequency of the lightning or static discharge; but when this has discharged the cells would choke back the current, and secure the interruption of the arc at the air-gap.

"Again, I may employ cells of this character as a safety resistance against two mains, or from one main to earth, so that a material rise of pressure will break down the resistance of the cells, which will then allow current to flow; but when the abnormal rise of pressure had disappeared, the current through the coils, will automatically fall to a small value as before.

"In all cases when alternating currents are used, the electrostatic capacity of the cells plays a part in their action, inasmuch as a certain part of the current flowing through is capacity current. As, however, more cells are introduced, this current diminishes as the effective capacity of the cells decreases, and as the number connected in series increases."

The above-mentioned English patent has been allowed to lapse. It would appear that in England the conditions under which the electrical industry is working are hardly advantageous to the development of such inventions. Firstly, of course, there is but a small demand here for high-voltage lightning protection, and therefore such work could not look for an immediate return. Secondly, such development work is very costly, and it was really financial considerations which unfortunately caused the whole thing to be dropped. However, the



ELECTROLYTIC LIGHTNING ARRESTER.

experiments made at the time were sufficient to show the great possibilities of the idea, and, judging from Mr. Jackson's paper, I think we had in 1901 proceeded as far as he has now got in his work. It is to be hoped that Mr. Jackson will be more fortunate than we were, and that he will succeed in the commercial application of the device.

The experiments carried out by the writer in 1901 had for their object the determination of the chemical and physical conditions for the best operation of the device; the mechanical considerations necessary for a commercial apparatus were also experimentally studied, and a number of experiments made under working conditions, of which the following short description must suffice. A pile of electrolytic cells was constructed as represented in the accompanying figures:

Each unit consisted of a shallow aluminum dish, and they were placed one on top of the other, and separated from each other by about ¼ in. by pieces of insulating material, as shown in the left-hand figure. The dishes were filled with the necessary solution, bichromate of potash being one of the solutions used. By pouring the solution into the top dish slowly, all the dishes were filled in turn by the solution running from one to the other. It will be seen that the dishes form a kind of battery of cells, the upper and lower surfaces of each dish acting as cathode and anode respectively. Such a resistance was found to be an excellent arrangement for placing in series with a spark-gap for the protection of conductors against lightning discharge. This follows from the property of the aluminum cell to resist the passage of electricity up to a certain point, and then to break down suddenly. For alternating currents, also, the cells act as a condenser of very large capacity. Placed in series with a spark-gap, the latter can be set extremely near the working voltage so as to form a very safe protection of the line. On a rise of potential, the gap arcs across and relieves the circuit, the electrolytic resistance instantly building up resistance directly the pressure has fallen to the normal value, and effectively prevents a large rush of current from the generators, and also the existence of any electric surging which so often results from free arcing in air on high-tension circuits.

A number of experiments under practical conditions were made, by kind permission of the chief engineer and resident engineer at the Wandsworth Station of the County of London & Brush Provincial Electric Lighting Company. This is a two-phase system running at 6600 volts, and the lightning arrester was connected between the bus-bars and earth, the former being fed by a number of generators totalling several thousands of horse-power. The spark-gap used in series with the electrolytic resistance was of the horn type, and this was set slightly lower than it would be set in practice, to facilitate the sparking across the horns. The action of the arrester tried was entirely satisfactory. The arc formed at the horns was quite small, and after running about two-thirds of the way up, was quietly and noiselessly extinguished. The horns were about 18 in. high. The resistance acted exactly in the way it was expected it would. At the instant of the passage of the current, the surfaces of each dish were covered with an innumerable number of tiny sparks, indicating the points where the non-conducting film broke down.

Another series of tests was made at the Hull Corporation Electric Lighting Station by permission of the chief engineer. The object of these experiments was slightly different from the above-mentioned ones. The system is 2000 volt continuous current. It was found practically impossible to switch off large currents from the generators. If one did so, a rise of potential occurred, and the commutators flashed over. The electrolytic resistance was found to be peculiarly suitable for preventing this. As the system was continuous current, it was possible to connect the electrolytic resistance directly across the bus-bars without any intervening spark gap. This is possible by reason of the fact that there is no capacity current flowing through the device on direct current. The following was one of the experiments tried:

A spark gap, consisting of a pair of horns was connected directly across the bus-bars, having only in circuit with it a long, thin fuse wire. On switching off any appreciable current, an inductive rise of potential occurred, which was evidenced by the thin fuse in series with the gap blowing. The electrolytic resistance was now also connected directly across the bars and the experiments repeated. Even when rupturing considerably larger currents, no discharge across the gap occurred, and the fuse never blew, proving conclusively that the electrolytic resistance, or condensor, effectually prevented any inductive rise of pressure. It should be mentioned that, in order to accentuate the effect, an oil-break switch was used for rupturing the current, and it may be added that the results obtained by breaking such a high-voltage direct-current on an oil-break switch were very instructive, if somewhat damaging to one's clothes. These experiments at Hull were made at the time when the supply of a number of switchboards to the Hull Corporation was being considered by the Ferranti Company. It was felt, however, that the electrolytic device was hardly ripe enough to put forward, as the corporation was in a hurry for the boards. As a consequence, another arrangement of gear was got out and supplied, which has been described in the technical press; and as the high-tension continuous-current system of working has not been adopted anywhere else in this country since the date

of the experiments, this matter has likewise been allowed to drop.

In conclusion, I would like to add that about the same time as the above-mentioned tests were made, I carried out a number of experiments on the use of these electrolytic films in wireless telegraphy. The idea I had was the use of the film as a detector, it breaking down under the influence of the etheric waves. Besides aluminum, the gaseous film of CO_2 formed on the anode when a solution of oxalic acid is electrolysed, was tried. These experiments were likewise abandoned, but it interests me to notice that such a responder has been lately practically applied by De Forest, and I believe, others.

Hollinwood, Lancashire, Eng. Charles C. Garrard.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors and Transformers.

Iron Losses in Non-Synchronous Machinery.—Wall.—The first installment of a paper in the first part of which the author discusses the losses occurring in non-synchronous machines, with special reference to the pulsation of the flux in the teeth. Experiments are described by which the losses due to the various causes have been found and separated by the "running-down" method. The results obtained from the experiments with a 7-hp motor are given. In the second part an investigation will be given of the magnitude of the pulsations of the flux in the teeth, and results of measurements obtained by means of search coils. Calculations will then be given deducing the losses from these measurements, and comparisons will be made with the results obtained in the first part.—*Lond. Elec.*, March 1.

Single-Phase Motors.—Thomaelen.—A mathematical article giving a simple method for determining by means of circular diagrams the slip, the torque and the losses in single-phase motors.—*Elek. Zeit.*, February 28.

Polyphase and Single-Phase Windings.—Goerges.—A translation in abstract of his recent German paper on a method of calculating the e. m. f. of polyphase and single-phase windings.—*Lond. Elec.*, March 1.

Converting Alternating into Direct Current.—Weiss.—A paper read before the Cologne Electrical Society on the relative advantages of synchronous and induction motor, generators and rotary converters, with reference to some details of design with various polyphase systems.—*Elek. Zeit.*, February 21.

Lamps and Lighting.

The Present Status of the Arc Lamp Industry.—An editorial review of the types of arc lamps now in use in Germany. The old arc lamp with two carbons, one above the other, the carbons being pure and non-impregnated and the air supply being not restricted, are still suitable for many cases. Their specific power consumption varies between 0.60 watt per (hefner) cp, for low-current lamps and 0.46 for high-current lamps, the volts being measured at the arc terminals. The life is from 8 to 20 hours, according to the length of the carbons. The quiet white light, the perfect regulating mechanism, the complete absence of obnoxious vapors render this type of lamp still very suitable for lighting halls and large interiors and for street lighting. While formerly two 40-volt or 45-volt lamps were used in series with a resistance on a 110-volt network, the waste of power in the series resistance is now avoided by connecting three 35-volt or 37-volt lamps across a 110-volt line, or six lamps across a 220-volt line without any series resistance and without any starting resistance. Enclosed arc lamps with a long life of the carbons were first used in Germany with a double globe, the inner globe immediately surrounding the arc. They have been found specially suitable in districts covering large areas and also near the sea coast, since the brine-containing humid air cannot easily enter the well-enclosed regulating mechanism. The disadvantage of the enclosed arc is its high specific consumption of power. (For a comparison with the conditions in this country, it is to be considered that wages and, therefore, the cost of attendance of open arc lamps are much lower in Germany.) More recently Germany has followed the lead of England and omits the outer globe and is also satisfied with a life of 150 hours. This is thought to be advantageous, because the lamps give somewhat more light and because the globes are generally so dirty after 150 hours' use that they ought to be cleaned. The enclosed arcs are either used single on 110-volt lines or two in series on 220-volt lines with a voltage of 70 or 80 at the terminals of the arc. The specific power consumption varies between 0.9 and 1.5 watt per lower hemispheric cp, the volts being measured at the arc terminals and a single clear globe being used in the test. "Very suitable" are said to be the latest modification of enclosed arc lamps, the so-called "small lamps." The 2-ampere lamps, brought on the market under the name of "liliput-," "perko-," "mignon-," "baby-" lamp, did not fulfill the hopes which had been placed in the same partly on account of the small candlepower and partly on account of the somewhat unsteady light; moreover, the high-candlepower metallic-filament lamps and the Nernst lamps are serious competitors of this type of arc lamp. For this reason manufacturers started to built these lamps in somewhat larger sizes, from 3 to 5 amperes. These lamps are now on the market under the name of "economy lamps" ("Sparlampen"), helia—or cohinoor-lamps; the life of the pencils is from 20 to 30 or more hours. These lamps have a graceful shape and attract the eye from a distance by their small, white, well-illuminated globe. They are in extended use for illuminating stores and show-windows. The enclosed arc lamp as such is made in sizes from 150 to about 1,200 hefner, lower hemispherical cp. To produce greater light intensities, the carbons are impregnated with certain salts. These lamps are made in two types. In the first type, the "flame-arc lamp" (Flammen-Bogenlampe) the carbons are placed one above the other; they are specially suitable for street lighting. The voltage at the arc is 40, so that two such lamps are used in series on 110-volt lines. In the second type, the "intensive flame arc lamp" (Intensiv-Flammenbogenlampe), the pencils are placed side by side. The voltage at the arc is from 45 to 47 and these lamps are at present the most economical producers of light. Their specific power consumption varies between 0.23 and 0.28 watt per hemispheric hefner cp with pencils for yellow light. Pencils are made for yellow, white and red light, but the pencils for yellow light still give the strongest light intensity, although the two other forms of carbons have been somewhat improved during the last years. Such lamps are built in sizes from 1000 to 5000 hefner cp. Their disadvantage is that their carbon diameter must be made small and the life of the carbons is therefore only from 6 to 20 hours. Since considerable smoke is developed by these lamps, they are not used in general for interior lighting. The intensive flame arc lamps are specially employed for lighting show-windows from the outside and for lighting squares and parks. Since the regulating mechanism is attacked by the vapors emitted from the impregnated pencils, attempts have recently been made to build intensive flame arc lamps without regulating mechanism. The Beck lamp (Elec. World, June 2, 1906, p. 1158) belongs to this type and is suitable for such plants in which the light need not be extremely steady. Carbone uses the same side-by-side arrangement of the pencils as in the intensive flame arc lamps, but employs pure, non-impregnated carbon pencils and raises the voltage of the arc from 45 to 75 or 80 (concerning his magnetic control of the arc see Elec. World, September 22, 1906, pp. 551 and 573). This lamp has a higher specific power consumption than lamps with impregnated carbon pencils, but gives pure white light and does not emit any vapors or gases. It is therefore suitable for interior lighting. The above figures

for specific power consumption relate to direct current. All these types of arc lamps are also built for alternating current, but consume in this case more electrical power with the only exception of the intensive flame arc lamps which have approximately the same specific power consumption with direct and with alternating current. For interior lighting different forms of indirect illumination may be employed. For perfectly indirect illumination, the light is sent upwards from the lamp and is reflected from the ceiling into the room. This method, which yields no shadows, but is expensive, is useful for draughting rooms and workshops doing accurate work. With half-indirect illumination the light is sent partly from the lamps directly into the room and partly upwards to the ceiling from where it is reflected. For indirect illumination ordinary open, pure-carbon arc lamps are used. With direct current the lower carbon is often made the positive one, to send the chief part of the light directly upwards, but the light is not quite as steady in this case as with the ordinary arrangement. For indirect illumination the enclosed arc lamp is also used, especially in factories where the materials are easily ignitable, as in textile mills, etc.—*Elec. Zeit.*, February 21.

New Incandescent Lamps.—LIBESNY.—Some notes on the new metallic-polamera lamps and on the application of the theory of radiation to the theory of electric lamps. A statement of Blau is mentioned to the effect that if two surfaces give the same light with the same expenditure of power, the smaller surface will be the hotter and the "blacker." The following list shows the surface which is required to emit 1 hefner cp with the ordinary type of lamp: Carbon filament, taking 3.5 watts per candle-power, has about 5.8 sq. mm of surface per candle-power. Carbon filament taking 1.5 watts per candle-power has about 1.2 sq. mm of surface per candle-power. Osmium filament taking 1.5 watts per candle-power has about 3.2 sq. mm of surface per candle-power. Osmin lamp taking 1.5 watts per candle-power has between 3 and 4 sq. mm of surface per candle-power. Osmin lamp taking 1 watt per candle-power has between 2 and 3 sq. mm of surface per candle-power. Tantalum lamp taking 2 watts per candle-power has 2.8 sq. mm of surface per candle-power. From this it would appear than an osmium lamp taking 1.5 watts per candle-power is at a lower temperature than a carbon filament running at the same specific consumption. Lombardi has arrived at a still more surprising result, working with a method suggested by Weber. He found that the temperature of an osmium lamp taking 1.5 watts per candle-power is 135° C lower than that of a 3.5 watt carbon filament. This, however, does not agree with the results deducible from the figures given above by the aid of Blau's law.—*Lond. Elec.*, March 1.

Power.

Electric Winding.—WOOD.—A paper read before the Manchester section of the (British) Institution of Electrical Engineers. The author discusses several new flywheel storage systems for use in connection with electric winding in mines. The object of the flywheel is, of course, to take up the very large variations of load. The first system is called the cascade flywheel storage system; it consists of two three-phase machines coupled together in cascade and attached to a flywheel, the main winding motor being three-phase. If a four-pole and a two-pole machine are in cascade then if the second machine is in circuit, the speed of the set will correspond to that of a six-pole machine, and if the second machine is cut out the speed will correspond to a four-pole machine. The disadvantage of the system is the poor power factor, since the main generator must supply the magnetizing current for the flywheel set under all conditions. The second system described consists of two induction motors, say, a 4-pole and 6-pole, coupled together with a flywheel between. These two machines are not in cascade, but a throw-over switch is arranged so as to connect either one machine or the other to the mains. To store energy in the flywheel, the throw-over switch is put on to the 4-pole machine, and to take energy from the flywheel, the throw-over switch is put on to the 6-pole machine. The disadvantage of this system is that it is somewhat costly, but the power factor is better than that of the cascade system. In the third system, which is better than the first two, the flywheel storage set consists of a synchronous motor with a revolving field; the rotor of this machine is of rather peculiar design, being almost exactly similar to a wound rotor of an induction motor (see Fig. 1). This motor is started

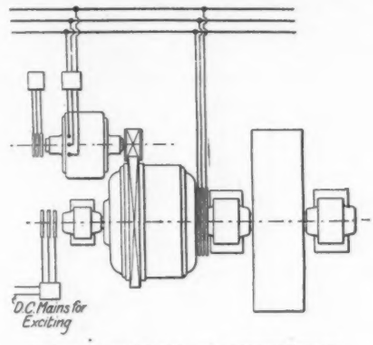


FIG. 1.—DIAGRAM OF CONNECTIONS.

up exactly as an induction motor, that is, with a resistance in each leg of the rotor, this resistance being gradually cut out as the flywheel attains its maximum speed. If use is made of a six-pole machine and the periodicity is 50, the flywheel will run at 1000 revolutions per minute when the stator is stationary. As soon as the speed is near synchronism, continuous current, supplied from another source (such as the exciter on the main generator), is applied between one leg of the rotor windings and the common junction thereof, the rotor being, of course, star connected. The motor at once pulls into synchronism. The two unused legs of the rotor winding are then short circuited and form amortisseur windings. The stator is carried on ballbearings from the nose of two pedestal bearings attached to the bedplate and is geared to a small three-phase, or continuous current motor, by spur, or skew gearing (Fig. 2). This small

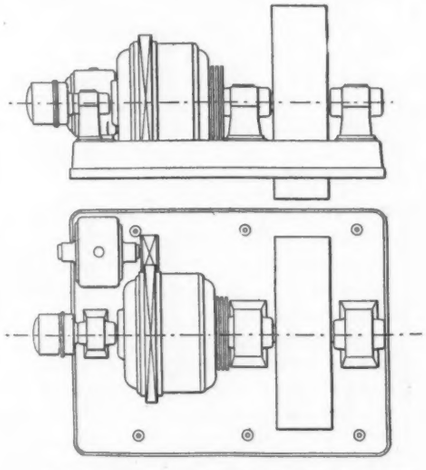


FIG. 2.—REVOLVING STATOR FLYWHEEL SET.

auxiliary motor is preferably reversible so that it will run at 200 r. p. m. in either direction, giving a variation of speed from 800 to 1200. This auxiliary motor is very often stopped and its capacity needs therefore to be only about 1/5 of that of the main flywheel motor. The main winding motor is three-phase and takes its current at full pressure from the mains, the starting being effected through resistance in the rotor, preferably of the liquid type. After the flywheel has been speeded up to its maximum (that is, by revolving the stator at 200 revolutions per minute in the same direction as the flywheel) the main motor is started up, the speed of the flywheel being reduced by gradually stopping, and afterwards reversing the motor controlling the speed of the stator. During this period the flywheel will be giving back energy to the supply mains.

Better control of this system can be obtained by using a small continuous-current motor revolving the stator, this machine being supplied with current from a small continuous-current generator direct connected to the flywheel storage system, these two machines being controlled by the Ward-Leonard system, with the excitation effected from the exciter on the main generator. In order to control the main winding motor, it is necessary first to have a lever arranged to open a valve, and admit water to the resistance tank connected to its rotor; at the same time, this lever must control a Ward-Leonard shunt rheostat which controls the speed of the stator case. One of the advantages of the system is that it is possible to use a flywheel of light weight running at a high speed, since the full power required for the motor does not pass through the flywheel set, which simply acts as a buffer dealing only with such proportion of the power above that previously determined to be taken from the generator or source of supply, the normal power going direct to the main motor without being transformed in any way. The author finally describes two continuous current systems which are called the "booster flywheel storage" system and the "compound flywheel storage" system.—Lond. *Elec. Eng'ing*, February 21.

Fuel Economics.—Goodrich.—An abstract of a paper read before the (British) Association of Engineers-in-Charge. In dealing with mechanical stokers, the author shows a decided preference for the coking stoker, especially from the point of view of smokelessness, but it is necessary that the firemen should not be continually slicing and breaking the fires. A lot of the trouble in connection with mechanical stokers may be obviated by proper supervision, instead of waiting until they break down. He considers that they can be kept in good repair for 5 per cent per annum on the capital cost. The author is strongly in favor of CO_2 recorders, and states that he knows of cases where they have been abandoned because, by laying bare defects, alterations involving expense had been foreshadowed. Sir A. Kennedy, who presided, in opening the discussion, drew attention to the fact that comparative figures showing the value of apparatus for reducing the coal bill are often unreliable and misleading; it is necessary to examine the original figures closely because, if the original test gives a bad result, the cause of the bad result should be ascertained, as it might be improved without installing unnecessary apparatus. He also drew attention to engine test results stated in pounds of coal per hp-hour. These tests include the losses in both the engine and the boilers, and such figures should not be taken in comparing tests on engines.—Lond. *Elec.*, March 1.

Installations, Systems and Appliances.

The Effect of the New Metallic-Filament Lamps on the Supply Voltage of Central Stations.—Wikander.—The new highly-efficient metallic-filament lamps are at present suitable for not more than 120 volts. The question is whether their appearance on the market will have any effect on the choice of the voltage of supply in central stations. (Especially in England, and to some extent in Germany, too, the tendency has been very strong in recent years to raising the voltage from, say, 110 volts to 220 volts, in order to increase the area over which energy can be distributed from a station.) The Association of (German) Electricity Works has made an inquiry as to how many of its members prefer the higher or the lower voltage. By far the majority is in favor of the lower voltage and it is recommended that, whenever possible, the supply voltage should not be chosen at more than 120 volts for new plants.—*Elek. Zeit.*, February 21.

Municipal Ownership in Great Britain.—Some notes on the experience of the municipality of Woolwich. It had formerly an electric lighting station owned by a company, which was not a large concern, the capital consisting of only $125,000 in shares and $50,000 in debentures. It was earning a dividend of 5 per cent. In 1901 the Borough Council decided to purchase the station and to enlarge the system. A new generating station was erected at Plumstead with alternating-current distribution, to run with the older system of direct current at Woolwich. The result was that the capital expenditure became excessive and there is now an annual deficit of from $70,000 to $75,000. The municipality also engaged in electric wiring with bad results. In an extensive report by Kennedy the capital charge is given as 4.4 cents per kw, but according to more recent figures in an editorial note it is more nearly 5.3 cents. Kennedy thinks that the supply system will be a burden on the taxes for the next 10 years. The immediate effect of the station being taken over by the municipality in 1903 is shown in the following figures: The net profit in 1902 was $17,315, the profit in 1903 $1,395, and the deficit in 1904 $16,345.—Lond. *Elec.*, February 22. The report of Kennedy is given almost in full in Lond. *Elec. Eng'ing*, February 21.

Central Station Economics.—Taylor.—A paper read before the Birmingham section of the (British) Institution of Electrical Engineers. The author first gives the following definitions. The "plant load factor" is the ratio of the average load on the generators, taken over the year, to the aggregate rated power (not over-loaded; but including spares). The "station load factor" is the ratio of the average load on the station feeders, taken over the year, to the maximum observed load on the station. The "consumers' load factor" is the ratio of the average load (taken in brake horse-power-hours where motors are concerned) given out, or absorbed, by consumer's apparatus to the maximum possible capable of being absorbed or given out. The "internal density factor," when applied to a motor load, represents, at any instant, the number of times which the sum of all the maximum loads on consumers' premises exceeds that observed at the central station. The "unrealized diversity factor" is the amount by which the observed diversity factor falls short of what it should be in order to satisfy the equation: consumers' load factor × average diversity factor = station load factor. The author then describes a method of separating running charges from standby charges and shows how to apportion the total charge to lighting, power and traction. Some of his results are as follows: The total charge debitable on account of running costs is much lower than is generally considered to be the case, varying from 0.60 cents per kw-hour in medium sized stations to 0.40 cents in the largest ones. For an "ideal" load, this includes all items of expense, right up to consumers' terminals, provided the mains already exist. The coal charge is by far the heaviest item of the running expenses. The "running" part of the coal charge is easily estimated for any one town as against any other, and for a given class of coal is sensibly constant over a large variety of stations. The author then shows that a large internal diversity factor on a motor load is a much overrated asset and may be a positive disadvantage. Anything tending to improve the combined diversity factor of the three classes of load is to be strenuously encouraged. The author finally discusses the possibilities of using storage batteries on consumer's premises. Storage on consumer's premises, if it can be proved to be practicable, is the only known means of providing a load which could be made at all times to accommodate itself to the amount of spare capacity available from the other two classes of load, thus realizing the highest average "combined diversity factor" possible. At first the difficulties of capital cost of cells and maintenance, as well as the supply voltage and the number of cells consequently necessary on each consumer's premises, may seem insuperable; but, on the other hand, there are the advantages of having a reserve supply on the premises, and recent accidents in London and elsewhere are believed to show that these advantages are very real. The standing and interest charges saved to the station and mains are of the order of 1.5 to 2.5 cents per unit, while the charges incurred on account of the cells are not above 1 cent, and in most cases this would provide for a complete renewal of the plates every five years.—Lond. *Elec.*, February 22.

London.—Pearson.—In a continuation of his illustrated serial on London electricity supply stations the author deals with the Stepney Borough Council system. The area of supply includes the most poverty-stricken district of London and practically all the Jewish quarter, but it also contains large numbers of thriving trades people and large factories. The station has been

continually extended since it was started and a very large proportion of the load is for motors. The generating plant capacity is about 3720 kw, of which 1000 kw may be reckoned as spare. This includes two turbo-generators. Each turbine is rated at 1600 hp and drives two dynamos of 500 kw each in tandem. These sets run at 1500 revs. per minute, and the dynamos have an e. m. f. of from 250 to 350 volts. A curious feature of these machines is that they are provided with three slip-rings, as well as commutators, so that they may be used for generating three-phase 50-period currents if desired. They are guaranteed to run sparklessly with two-thirds continuous current and one-third alternating current, or with two-thirds alternating current and one-third continuous current, and are provided with compensating windings. Another feature of interest is that the turbines are at present arranged to run non-condensing by omitting rings of blades at both the high-pressure and the low-pressure ends; but by the insertion of these rings the turbines can be made suitable for running condensing. It is, of course, anything but usual to run turbines non-condensing, and it was only done in this case because there is no condensing plant on the existing site. It was intended, therefore, that these machines should be installed only temporarily, and should ultimately be removed to the proposed new station on the river bank, there to run condensing. Every effort is being made to secure a large motor load. The maximum demand system of charging is in use and has proven entirely successful. For lighting purposes 16 cents per kw-hour is charged for the first 30 hours' use of the maximum demand during each of the six months ending March, inclusive, and for the first 20 hours' use during each of the six months ending September, inclusive; 2 cents per kw-hour is charged for all further consumption in each month. For motors at 480 volts, and for all purposes other than lighting there is a flat rate of 2 cents per kw-hour. Small motor service supplied at 240 volts are, however, charged at lighting rates. There is also a minimum charge of $3.33 per quarter. These rates are for consumers the semi annual bill of which does not reach $300. For large consumers cheaper rates are provided. The average price paid per kw-hour for lighting only is less than 5.5 cents. In all probability this constitutes a record for London and the South of England.—Lond. *Elec.*, March 1.

Central Station Management.—An editorial discussion of the needs of the moment in British central station management. Unless constant extensions are in progress, there is no longer a pressing need for a highly skilled engineer at the head of affairs. With a properly trained staff the operating side of the station, as distinguished from the selling, would be in the right hands. The chief engineer should divide his time about equally between technical, legal, commercial and committee matters. If he is an engineer he will favor the mechanical and electrical branches of the system to the detriment of the other branches. The writer recommends the appointment of a commercial engineer, whose duties shall consist solely in getting new business. His responsibilities would commence at the consumer's meter, and, in addition to possessing abilities as a salesman, he would require actual knowledge and experience of illuminating engineer, electric power and heating installations.—Lond. *Elec.*, March 1.

Australasian Station.—An illustrated article on the municipal electricity works of Christchurch in New Zealand which are operated in combination with a refuse destructor with good financial results. The station contains two 100-kw and one 150-kw direct current machines and a large storage battery with a capacity of 1200 amperehours.—Lond. *Elec.*, March 1.

Water Rheostat.—BERNARD.—An illustrated description of an arrangement of water rheostats. The object is to automatically refill the resistance vessel from a large reservoir, in order to compensate for the evaporation of the water during use.—*Elek. Zeit.*, February 14.

Electrophysics and Magnetism.

Effect of Electric Discharges on the Acetylene Flame.—LORENZ.—An abstract of a Physical Society paper. The author found that the brightness of the light emitted by a cylindrical jet of acetylene issuing under considerable pressure from a small hole, could be increased about five-fold by the passage through it of the electric discharge from an induction-coil, the primary of which was fed with alternating current. The pointed brass electrodes were placed in the invisible mantle of vapor surrounding the flame out of contact with the luminous part, one being placed near the base and the other near the top or middle of the flame on the opposite side. Simultaneous measurements were made of current, candle power and voltage. The author found a linear increase of candle power with current up to a limiting value. The difference of potential first increased with increase of current, as in the case of an ordinary resistance, and then decreased as in the case of an arc. Observation of the flame by means of a rotating mirror showed that it shortens and brightens each time the discharge passes. Several applications are suggested. For example, the phenomenon may be applied in cases in which it is desired to produce rapid variations in the intensity of a light by means of small currents, such as microphone currents; the secondary of an induction coil, which may serve at the same time as a steadying resistance, is put in series with the flame and the variations or interruptions made in a circuit containing the primary.—*Phys. Rev.*, February.

Ionization of the Atmosphere over the Ocean.—EVE.—An experimental investigation in which the author found that the emanation from the radium in sea-water, and the penetrating radiation from the active matter contained in it, are insufficient to account for the ionization observed over the ocean. Emanation arising from radium on land, and carried to sea by the wind, is the only known cause which will account for the ionization effects observed over the ocean. The ionization observed is larger than would be anticipated from such a cause, but it is possible that the rate of recombination of ions over the sea may be less than over the land.—*Phil. Mag.*, February.

Ionization of Air in Vessels.—WOOD AND CAMPBELL.—The ionization of air and other gases in a closed vessel undergoes a permanent increase for a considerable time after the gas contained in it has been enclosed, but this increase depends on the nature of the vessel, being comparatively large for lead and tin vessels and negligible for zinc vessels. Superimposed on this variation of the ionization is a periodic variation having two maxima and two minima each twenty-four hours. In their main features the curves representing this periodic change are the same as the curves representing the variations of atmospheric potential, and the author hopes in a later paper to establish a connection between the two variations.—*Phil. Mag.*, February.

Radiation Incident on a Moving Surface.—DAVIS.—A paper referring to Bartoli's investigation which proceeded from his thermo-dynamic proof of radiation pressure. He performed some experiments seeking to observe the expected radiation pressure, but failing to detect it, concluded that it does not exist. It occurred to him that perhaps his failure was due to the conversion of the incident power into currents in the conducting surface. He made some experiments which appeared to show such an effect, but the present author in again studying this problem experimentally obtained negative results. He concludes that the existence of the effect described by Bartoli is not established and must remain in doubt until again observed by other experimenters.—*Phys. Rev.*, February.

Spark Potentials in Liquid Dielectrics.—SHAW.—A note summing up the differences in the arrangement of the experiments and in the results obtained by himself and by Earhart.—*Phil. Mag.*, February.

Electrochemistry and Batteries.

Induction Furnace.—ROECHLING.—An illustrated description of the tilting type of Kjellin electric induction furnace for the refining of steel, which is in successful operation at Voelklingen in Germany.—*Electrochem. and Met. Ind.*, March.

Electric Furnace.—KERSHAW.—The continuation of his illustrated serial of electric-furnace methods of iron and steel production. In the present installment the author deals with the methods of Keller.—Lond. *Elec.*, February 22.

Black Sands.—DAY AND RICHARDS.—A long abstract of the official report of the United States Geological Survey researches

on the winning of metallic values from black sands of the Pacific Slope. The abstract gives in full the electric-furnace experiments which were made with a view of getting steel from black sand.—*Electrochem. and Met. Ind.*, March.

Units, Measurements and Instruments.

Three-Wire Watt-hour Meters.—Solomon.—The energy in a three-wire system may be easily measured by putting one two-wire watt-hour meter into each half of the system. The main-current coils are placed in the outers and each voltage-coil is connected across one outer and the neutral wire. If only a single three-wire watt-hour meter is used, the results are not always correct. The Aron three-wire meter used either with direct current or alternating current with a balanced or unbalanced system and for any power factor always gives correct results, since it is essentially a combination of two separate meters. Each of these has a stationary main-current coil and a voltage-coil which oscillates with the pendulum. The two main-current coils are placed in the two outers and each voltage-coil is connected between one outer and the neutral. On the other hand, if a direct-current, three-wire, watt-hour motor-meter, like the Thomson meter, has two stationary main-current coils and one voltage-circuit, containing armature, auxiliary coil and ballast resistance, its readings are correct only when the two halves of the direct-current three-wire system are equally loaded. The error with an unbalanced system is due to the fact that there is only one voltage circuit. If the voltage circuit is connected across the outers the readings of the meter will be too high but the error will be small. On the other hand, if the voltage coil is connected between one outer and the neutral wire, the readings will be either too high or too low, according to whether the one half to which the voltage coil is connected carries more or less current than the other half. But the error of the meter is much higher in this case than in the case just mentioned. If in an alternating-current three-wire system a three-wire single-phase induction meter is used with only one voltage circuit but two main-current coils inserted in the outers, the error will depend not only on the lack of balance of the system but also on the power factor.—*Elek. Zeit.*, February 28.

Mutual Inductances for Laboratory Use.—Rosa.—An abstract of a Physical Society paper. The most accurate as well as the most convenient method of calibrating a ballistic galvanometer is by means of a mutual inductance, through the primary of which a measured current flows. Suitable primary and secondary coils, wound on a thoroughly seasoned wood spool (or a marble spool) only 10 or 12 cm in diameter, afford, when calibrated, an accurate and convenient mutual inductance for the calibration of galvanometers that is cheap, portable and reliable. Such an inductance unit is so inexpensive and occupies so little space that it can be left with its secondary in circuit with the galvanometer, ready to be used for calibrating the latter at any time. It can be made in the laboratory at trifling cost and can be sent by mail or express to the Bureau of Standards and calibrated at very slight expense. Specifications for such coils will shortly be published by the Bureau.—*Phys. Rev.*, February.

Mutual Inductance.—Rosa.—An abstract of a Physical Society paper. The constant of the Lorenz apparatus for the absolute measurement of resistance and of the Ayrton-Jones electrodynamometer for the absolute measurement of current require the calculation of the mutual inductance of a circle and a coaxial helix, the circle in the first case being the edge of the rotating disk and in the second case one end of the suspended coil, the helix being the fixed coil carrying the primary current. The author has given a new and simple formula for the mutual inductance. His expression is obtained on the assumption that the current is distributed over the solenoid in a uniform current sheet, whereas a similar expression of Jones assumed the current flowing in a helix. Their agreement is a confirmation of the theorem that a spiral distribution of current is equivalent to a current sheet.—*Phys. Rev.*, February.

Telegraphy, Telephony and Signals.

Slightly Damped Oscillations.—Mosler.—It has long been known that electric oscillations are produced in a circuit containing a capacity and an inductance in shunt with an electric arc. In Poulsen's modification of this method for the purpose of producing undamped electric oscillations, the oscillation energy is increased by lengthening the arc by means of magnetic deflection. The present author shows that the same result is obtained by purely mechanical deflection of the arc by means of an impinging air or gas current. The phenomenon goes on as follows. When the air current impinges on the arc, the latter is deflected and lengthened, the resistance increases; the current therefore decreases and the arc contracts again; the current increases and under the influence of the impinging air the arc lengthens again and so on. This is repeated thousands of times per second. The conditions of resonance must, of course, be fulfilled between these oscillations of the arc and the oscillation circuit in parallel.—*Elek. Zeit.*, February 14.

Transmission of Pictures.—Korn.—A translation in abstract of his recent German paper on his improved method of electrically transmitting photographs.—Lond. *Elec.*, March 1.

Miscellaneous.

Accidents in Mines.—Rinkel.—A statistical review of electrical accidents in mines which occurred in Germany in 1904 and 1905. There were 36 accidents in all, of which 15 were fatal. Of the latter, 5 occurred in 1904 and 10 in 1905. This increase is due to the more extended use of high tension. In normal operation only 10 accidents happened, none of which was fatal. During repairs, extensions and inspections 15 accidents happened, of which 9 were fatal. This class of accidents is the most serious one. Five accidents, of which three were fatal, were due to foolishness of workingmen and their presence in high-tension rooms which they were not permitted to enter. Five accidents, of which two were fatal, occurred to workingmen who had nothing to do with the electrical installation but slipped out and in falling tried to hold themselves by grasping electric conductors. Finally in one case one man was killed whose cheek came in contact with an overhead wire carrying direct current at 220 volts for locomotive hauling, while he was standing with his feet on moist ground. He was not killed immediately and his life might have been saved if proper attempts had been made to revive him.—*Elek. Zeit.*, February 28.

Observatory and Generating Station.—A report on the effect of vibrations from the Greenwich generating station on the Royal Observatory situated at a distance of half a mile; and on the question of chimney and chimney-gas obstruction.—Lond. *Elec.*, March 1.

BOOK REVIEWS.

Wissenswertes ans dem Dynamotan für Installateure. By Ernst Shulz. Hannover: Max Janecke. 159 pages, 77 illustrations. Price, 2.20 marks.

This book contains in simple form general elementary information on dynamo-electric machinery, and will be read with ease by beginners and will help them to understand the principles involved.

Handbuch der Elektrotechnik. Vol. VI. By Pohl & Soschinski. Leipzig: S. Hirzel. 448 pages, 395 illustrations. Price, 20 marks.

This book is the first part of Vol. 6, of the Handbuch der Elektrotechnik series, the subdivision being necessary on account of the great amount of material to be presented. The first part covers conductors and insulating material, the manufacture of conductors, switches, fuses and protective devices for high potentials and atmospheric discharges. The first 190 pages treat of conductors, cables and insulating material in an exhaustive manner, theoretically as well as practically. Many valuable tables are given which are of use not only to cable and

wire makers, but also to constructing and consulting engineers as well as electrical manufacturers. Among these may be mentioned a wire table of conductors, giving specific gravity, tensile strength, limit of elasticity, conductivity, specific resistance and temperature coefficient. A second table gives comparative weight, diameter and resistance of copper and aluminum conductors. Another shows the difference between the current-carrying capacity of the same conductor for the same temperature rise when exposed to the air or when shut up in a room. This table was first published by Dr. Kennelly and is supplemented by another by Uppenborn in which the conductors were covered with lampblack and shellac. Several other tables relate to resistance of commercial insulating materials with regard to break-down e. m. f. at given air temperature and humidity. There are also tables relating to insulators used especially in cable manufacture, and giving the various ingredients used in the insulating compounds of commercial cables.

Electrical conductors are treated, first in a general way and then with respect to cable sections and various materials employed. The more important conductors, such as copper, iron and aluminum are discussed, and their respective fields of application and comparative prices considered. The authors then go extensively into the various insulating materials used for conductors and apparatus, discussing insulated wires and deteriorating influences, temperature rise of circuits, the resistivity of insulators against breakdown, dielectric hysteresis and its determination, and the dependence of losses on temperature change, pressure and frequency.

Another chapter takes up the subject of guttapercha. Among the more important details treated may be mentioned physical and electrical properties, resistance to high pressure, mode of application to wires, durability in water and soil. In a similar way caoutchouc is treated, including its utilization, vulcanization, etc. In succession paper, linen, jute, cotton, silk, oils and minerals are discussed and their production, application and properties enumerated. Then follows a description of wood, rubber, fiber, marble, slate, mica, asbestos, etc., and their application to apparatus, succeeded by descriptions of the commercial methods of manufacturing insulated wires and cables. The descriptions include many special machines required for this purpose. Attention is given to testing the finished products, various methods and the necessary instruments being shown and described.

The subjects next taken in hand are circuit-controlling switches and cut-outs. After enumerating some direct-current experiments of spark length, the various types of switch-blade contacts are shown, followed by many forms of snap switches, all of which are of European type. Attention is called to several types of time-controlled switches, followed by appliances for long-distance control, plug switches for house and street service and numerous wiring diagrams for controlling groups of lamps from more than one point. Then, in turn, are taken up high-tension switches with restricted chambers adapted to suppress quickly the formation of an arc, the types in which the arc is dynamically dissipated, and oil break switches. The chapter concludes with a description of numerous types of circuit-breakers and storage battery grouping switches.

The subject of fuses, requiring sixty pages, is an able presentation of the various purposes of this device, its construction and testing, and illustrations are given of proper location and limitation in circuits, followed by single and grouped fuses, plugs and cut-outs of European make. The remaining space of nearly sixty pages is devoted to lightning protection and abnormal line pressures. This subject is treated first from a theoretical standpoint and accompanied by illustrations of many protective devices of American, as well as European make. The ground-plate, so generally neglected, receives from these painstaking writers the deserved and needed care and treatment. The book is a mine of information on the subject of which it treats, and will be of great service to professors, engineers and manufacturers alike.

Rateau-Ballwood Steam Turbine.

The Ball & Wood Company, Elizabethport, N. J., recently completed a 125-kw steam turbine constructed according to the designs of Professor Rateau, of Paris, and supplied by the Rateau Turbine Company, as illustrated in Fig. 1. The turbine was built for use with a Western Electric generator, to which it is shown directly coupled in the illustration. The Rateau turbine is of the multicellular type as distinguished from the drum type to which the Parsons turbine belongs; it operates on the impulse, or action, principle rather than on the reaction principle as does the latter. It is claimed that by this construction the steam leakage is reduced to a minimum, and that the rotating parts being in perfect balance as regards pressure, the element of end thrust is completely eliminated.

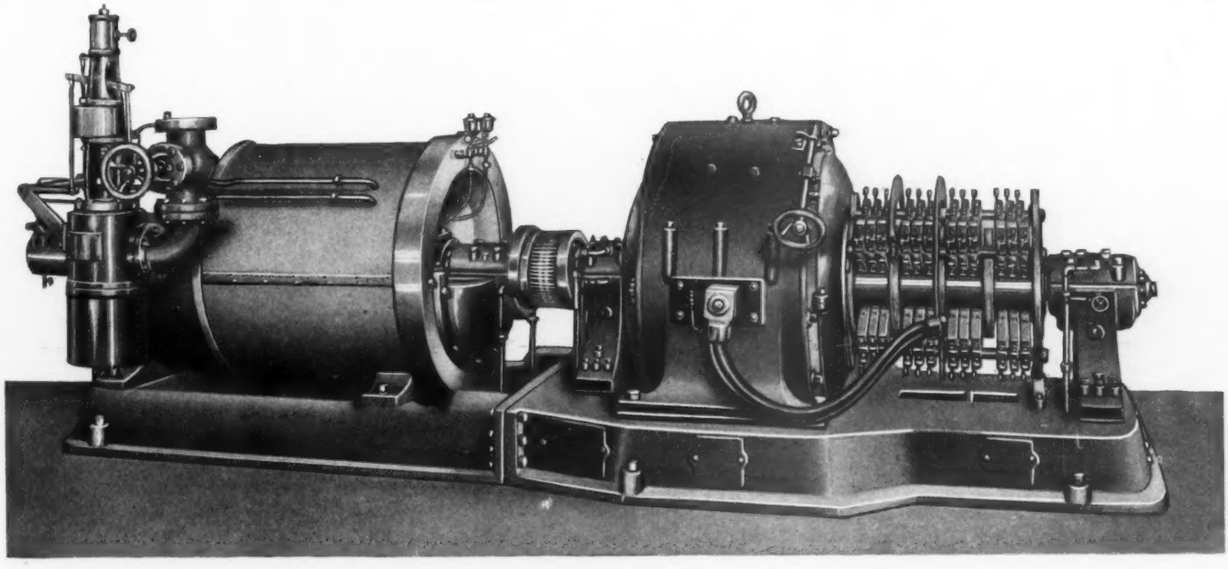


FIG. 1.—GENERAL VIEW OF TURBINE, SHOWING COUPLING WITH COVER REMOVED.

The revolving element consists of a series of light flanged steel disks upon the periphery of which are riveted vanes as

indicated in Fig. 2. Surrounding the vanes and riveted to them is a steel band which serves to maintain equal spacing and rigidity. Fig. 5 shows the lower half of the stationary member of the turbine. Each disk is arranged to revolve between circular diaphragms in the interior of the casing. These diaphragms are provided with guide vanes or distributers (Fig. 4). The spaces in each distributer are located with reference to those in the adjacent diaphragms so that the steam leaving one moving wheel enters directly into the following distributer without producing any shock and in a manner which practically utilizes the residual velocity of the steam as it leaves the wheel. On account of the progressive expansion of the steam, the moving vanes are much longer at the exhaust end than at the admission. The speed is controlled by a centrifugal governor located on the end of the shaft which throttles the steam admission according to the load on the unit.

FIG. 2.—REVOLVING ELEMENT IN PLACE.

The turbine is provided with a simple type of self-oiling bearing, ordinary rings on the shaft dipping into oil wells. The oil itself is cooled by a water jacket which completely surrounds the bearing. No oil is carried to the condenser, so that the water from the condenser can be used at once for feeding the boilers.

The turbine has been designed to operate at 3000 r. p. m. when fed with steam at 165 lbs. pressure and exhausting into a condenser which maintains a vacuum corresponding to 27 inches. An automatic stop is used to prevent the speed from increasing to an unsafe limit.

Mounted on the same bed plate and connected thereto by means of a flexible coupling is the generator referred to above. The generator is a 125-kw direct-current machine, wound for 125 volts. The special precautions adopted in the construction of the stationary and revolving members in order to insure sparkless commutation reside in the use of commutating poles on the stator, and shrink rings for holding the commutator in place on the rotor. Both of these means are rendered necessary by reason of the high speed, the former because of the rapidity with which the current must be reversed in each coil during the commutation period, and the latter on account of the high centrifugal force on the commutator segments.

FIG. 4.—GUIDE VANES.

One of the most interesting features of the turbine unit is found in the coupling used for transmitting the torque of the turbine shaft to the shaft of the dynamo. Although the coupling is constructed of metal, it is of a flexible type and allows the two machines to operate as a single unit without strain on the shaft or bearings, even though they should be slightly out of line. Moreover, a shock on the dynamo would be transmitted to the turbine as a cushioned blow, while any abnormal blow on the turbine would be greatly softened before it reached the generator. Mechanically considered the coupling is extremely simple. It consists of a flange keyed securely to the end of the turbine shaft and a similar flange similarly mounted on the

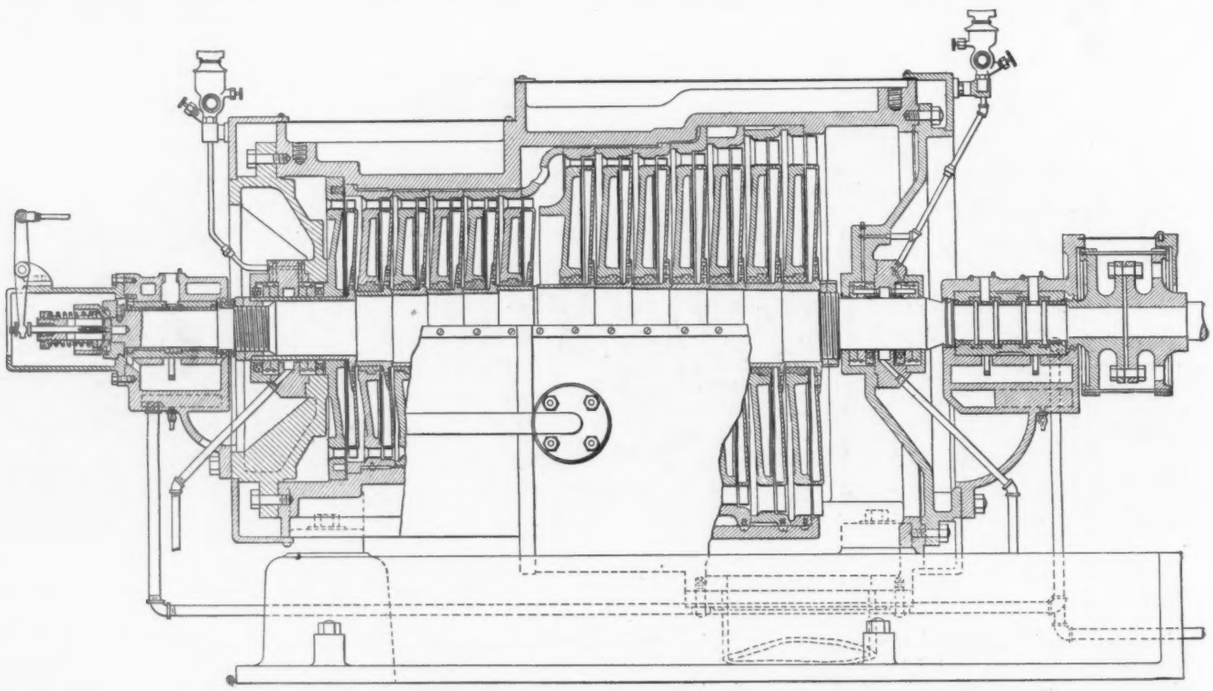


FIG. 3.—SECTIONAL ELEVATION OF TURBINE, SHOWING CONSTRUCTION OF FLEXIBLE COUPLING.

dynamo shaft. In the face of each flange there is drilled a considerable number of holes in which are placed small steel rods which are given an easy fit. The faces of the flanges are separated from each other by about five inches. Thus the turning moment on the turbine flange is transmitted to the dynamo flange through the force exerted by the 5-in. portion of each rod which flexibly resists the torque acting between its two ends. The details of construction of the coupling are indicated in Fig. 3, while a view of the completed coupling with

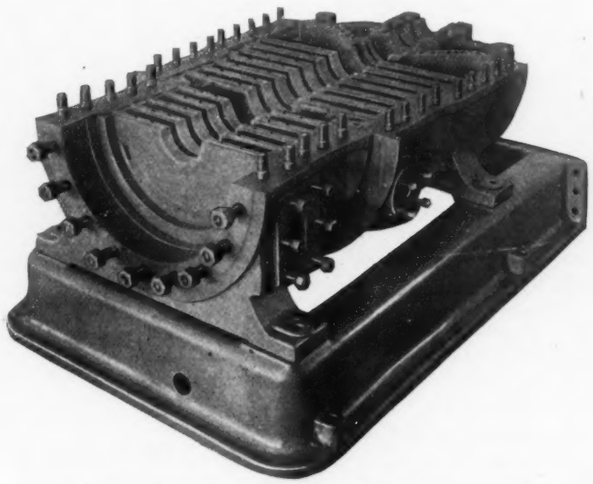


FIG. 5.—LOWER HALF OF THE STATIONARY MEMBER.

the protecting cover removed is given in Fig. 1. For the purpose of preventing a complete rupture of the rods in case of accident, the coupling is provided with a second pair of flanges almost in contact with each other in which are arranged four bolts fitted tightly into one flange but given considerable clearance in the other, so that under ordinary conditions they assume no part of the torque.

Helios Luminous Arc Lamp.

The accompanying illustrations show the luminous arc lamp brought out by the Helios Manufacturing Company, of Bridesburg, Philadelphia, Pa. The main structure of the lamp consists of a heavy brass tube connecting the lower brass plate with the upper casting, the latter having attached to it a casting which supports the resistance spools and the carbon holder guides. Inside the main tube is a rod operated by a magnet in the top of the lamp which is energized when the circuit is closed. This draws the rod upward and thus by means of a presser foot at the lower end of the rod, separates the carbons and strikes the arc.

The blowing magnets, shown in the illustration, as well as the plunger magnet are wound with asbestos insulated wire. The flexible cables leading to the carbon holders are, as usual, insulated with glass beads. The resistance is wound on spools of grooved porcelain, so that burn-outs from this cause are minimized. Reference to the engravings will show that there are no clutches, chains, gears or shunt windings in this lamp. The lamp feeds by gravity and the bridge connecting the carbon holders is said to insure equal feeding of the carbons.

The cases are made of brass or bronze in any desired finish and are fitted with special shaped globes designed to permit the rays of light to emerge nearly at right angles, or, in other words, the shape of the globe is practically the shape of the arc itself. The lamps require 40 volts at the arc, so that they may be operated two in series on a 110-volt circuit, and when so operated and adjusted for a current consumption of 10 amperes, the lamps consume, it is claimed, only 0.25 watt per mean hemispherical candle-power. The lamp will burn when operated four in series on a 220-volt circuit and by the addition of two resistance spools, for which provision is made in the lamp, they can be adapted for operation singly on 110-volt circuits, or two in series of 220-volts, although the operation is not so economical under these conditions.

All parts of the lamp are built to gauge. The resistance is

FIGS. 1 AND 2.—LUMINOUS ARC LAMPS.

self-contained and although the carbons are 400 mm long, the length of the lamp from the top of the hanger eye to the bottom of the globe is only 30 ins., and the weight of the lamp complete is 25 lbs.

Relative Merit of Different Types of High-Tension Insulators.

An article in our issue for July 14, 1906, contained a report of some interesting tests made upon ambroin high-tension insulators of the Kleinsteuber type as manufactured by the Vereinigte Insolatorenwerke Actien Gesellschaft, of Berlin, Germany. On January 12, 1907, we published a description of certain forms of ambroin insulators.

As shown in the latter article the insulators are not of the multiple-petticoat form commonly used for high-tension work. The ordinary ambroin insulator consists of a single bell; for very high potentials a disk of insulating material is used for separating the bell from the cap. Several of these insulators were recently tested at the Reichsanstalt, the result being then compared with test results obtained with multiple petticoated porcelain insulators, as shown below. It was found that the ratio of the arcing potential in rain to that in dry weather (designated by the letter a), varied from .30 to .52 for porcelain insulators and from .52 to .80 for ambroin; the ratio of the arcing voltage in rain to the weight of the insulator in grams (designated by the letter b) varied from .14 to .47 for porcelain and from .47 to .67 for ambroin; the product of a and b (designated as g and called the "utility figure" of the insulator) varied from .7 to .19 for porcelain and from .24 to .47 for ambroin.

These facts are well shown in the accompanying illustration, where the insulator to the left is of the ambroin type, while the other is of porcelain. The latter had a maximum diameter of

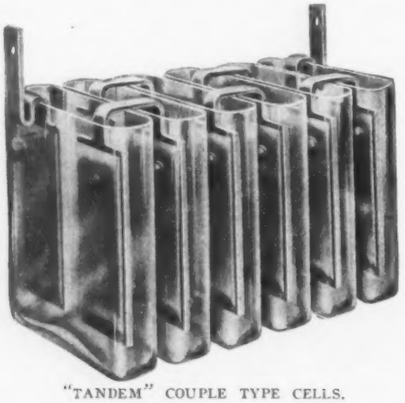
177 mm, height of 140 mm, and weight of 1950 grams. The former had a maximum diameter of only 135 mm, height of 140 mm and weight of 790 grams. The two insulators were connected in parallel and were subjected to 40,000 volts in an artificial rain falling 8 mm per minute. As shown in the illustration, the arcing on the ambroin insulator was barely noticeable, while the porcelain insulator was wrapped in flames.

TEST OF AMBROIN AND PORCELAIN INSULATORS.

A New "Couple" Type Storage Battery.

For the particular work of fire alarm telegraphs and similar installations, the "couple" type of storage battery, which consists of a single pair of plates in each cell, has been found particularly advantageous, as but small ampere capacity is needed for this class of service, while a low rate of discharge, accessibility of parts and especially absolute certainty of action are essential. For this service the Gould Storage Battery Company has devised a new type of cell shown in the accompanying illustration.

Necessarily the action between the positive and negative sides of storage battery plates which face each other is far more intense than between the sides turned away from each other, so that charge and discharge take place mainly on the facing sides, producing a tendency to buckle and wear unevenly. To eliminate these defects the plates in the new type are placed edge to edge instead of face to face, as shown in the illustration.



"TANDEM" COUPLE TYPE CELLS.

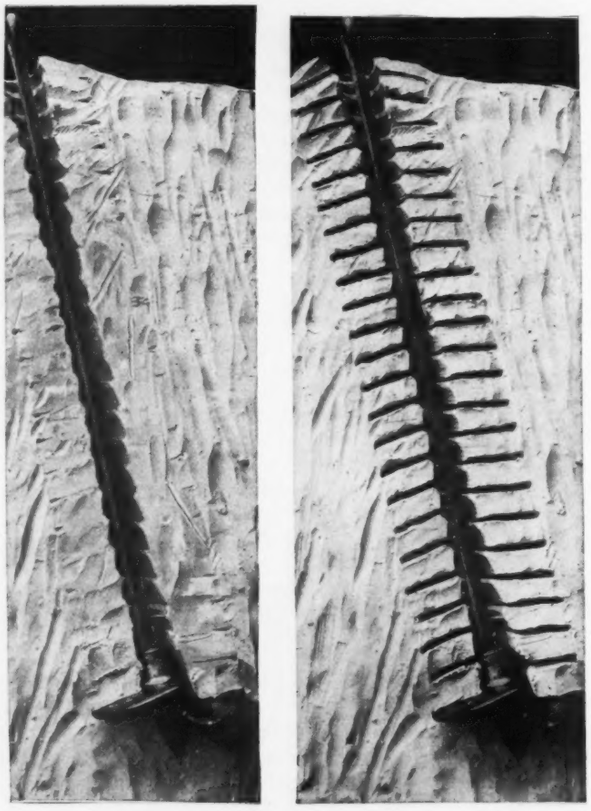
As all parts of both sides of both plates are exposed to exactly the same conditions of acid-supply and exposure to the electrolyte, charge and discharge proceed at the same rate in every part of the grid, which, owing to its peculiar "spun" construction out of hard rolled integral lead, and its proportions of reserve lead base to active material, will, it is claimed, retain its original capacity and shape intact for many years, no part giving way until the whole plate all over gives out by complete consumption.

The positive plate of each cell is permanently joined to the negative plate of its neighbor by broad, thick, substantial curved lead bonds, "burned" to the plates, so that no bolts are used except at the end of each row of cells. This permanent connection saves considerable time and trouble in assembling the battery, enables the plates to be quickly lifted out for inspection as well as for cleaning of the cell, and avoids corrosion of bolted connections by sulphuric acid fumes, besides having practically negligible ohmic resistance. This construction also presents other advantages, such as low internal resistance, low first cost, accessibility for inspection and absolute reliability of operation for use in fire alarm and police telegraphs.

Strains on Guy Anchors.

Some tests have been made recently by Prof. R. C. Carpenter, of Cornell University, on strains on guy anchors, to exemplify the strains they will withstand. It appears from some seventy-odd tests on different sizes by the use of a dynamometer that a 5-in. Stembaugh guy anchor would hold 12,500 lbs., a 6-in. anchor 15,000 lbs., an 8-in. anchor 20,000 lbs., a 10-in. 25,000 lbs., and a 12-in. 30,000 lbs.

The illustrations shown herewith explain this very clearly. Fig. 1 shows an actual photograph of a 12-in. anchor from which half of the clay into which it was screwed was dug away carefully. One can see by close examination where the helix or screw of the anchor passed through the clay, but it is to be noted that the solid clay was not disturbed and that the anchor left practically no trace of where it went in. Metaphorically, it "goes into a hole and pulls the hole in after it." Fig. 2 shows the same anchor after the cuts of the helix have been carefully opened up to show the path of the anchor after it was screwed in. This test was made in modeling clay for convenience in handling and because it holds its shape better. The manufactur-

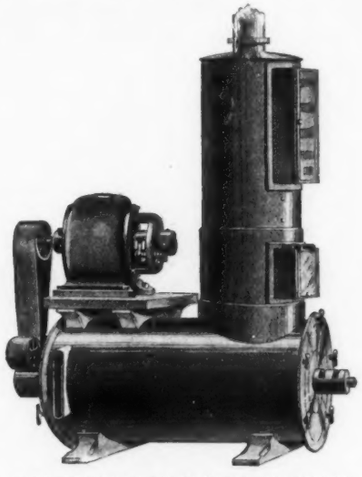


FIGS. 1 AND 2.—GUY ANCHORS.

ers of this type of guy anchor are W. H. Matthews & Bro, 227 North Second Street, St. Louis, Mo.

Electrical House Cleaning.

What may be well termed a new science, the science of house cleaning, owes its latest development and wide applicability to the electric motor. The age of the broom and dust pan is fast passing, and instead of the old method of stirring up the dust and allowing most of it to resettle, modern ingenuity has devised the simple expedient of sucking the dust and germs through tubes, from floors, books, upholstery, carpets or any other place where it accumulates, and collecting it in a condensed condition in a suitable receptacle. In addition to its hygienic perfection, this scheme has the advantage of ease and consequent cheapness in manipulation. The exhauster and



ELECTRICALLY-DRIVEN DUST EXHAUSTER.

dust-separator can be conveniently located in the basement and connected by piping with the various rooms and halls, where suitable flexible connections are made.

The fact that the exhaust-collector requires power to drive it at first limited the application of this principle to hotels and factories having power plants, but the application of the electric motor has greatly extended its use. At present theatres, office buildings, churches and residences are being extensively equipped.

The Crocker-Wheeler Company, of Ampere, N. J., has been for some time supplying motors to drive dust-exhausters of various designs, and the cut illustrates a very recent application equipped with one of its well-known types of motors.

Decade Testing Set.

The testing set illustrated herewith has been designed with special reference to light weight, small size and constancy of contact resistance. Practically no part of the hard rubber top is "dead space;" the rheostat sections are arranged in the form of circular arcs, while the bridge sections occupy intermediate sections between these arcs. In order to insure constancy, the contact switches are constructed of straight leaves beveled at the outer end and making contact with an under surface of each individual contact block, the under surface being chosen as naturally remaining much cleaner and dust free than the usual top-style contact.

The galvanometer is of the D'Arsonval type with a long, narrow coil, securing thereby a high sensibility with extremely dead-beat action. A specially arranged Ayrton shunt allows the galvanometer a much wider range of application than heretofore, shunting values of 0.1 and .01 being provided.

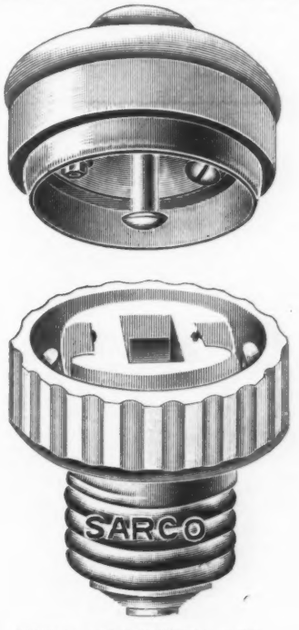
The set is provided with a battery of six special dry cells mounted in the base with their terminals extending through the side. The complete set weighs only 11 lbs.; it is 9.25 in. long, 7

TESTING SET.

in. high and 7.5 in. deep. It has just been placed on the market by Queen & Company, Inc., Philadelphia, Pa.

Separable Swivel Attachment Plug.

The attachment plug illustrated herewith is provided with a circular brass band inserted in the top cap, which is swivelly operated and connected to the bottom portion of the plug, where it engages with two phosphor-bronze circuit-makers; the second contact is made by a center-pole in the form of an extended



SWIVEL ATTACHMENT PLUG.

stud, which engages in a ball-bearing lock, so that the plug can be separated at any angle. Thus, if the cord should be pulled sidewise in any direction whatsoever, the plug will separate readily. The plug can be inserted complete into a socket; if the cord becomes twisted, it can be untwisted at once on account of the swivel feature.

This plug has recently been placed on the market by the Sarco Company, 906 Sixth Avenue, New York.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports from all over the country to the leading commercial agencies show no diminution in the volume of trade at this season, except where unfavorable weather conditions have prevailed. Severe declines in the stock market, high rates for money, slightly more unrest in labor lines, and heavy rains and floods in the Ohio Valley, are the principal unfavorable features. While business is large, there is claimed to be no tendency to purchase beyond legitimate requirements, and the prospects favor active demand and a large turnover. Spring trade is making a most satisfactory comparison with the volume at this time last year, except in a few sections where the weather is still unfavorable, and mercantile collections improve steadily despite the high money rates. Commercial and manufacturing activities expand regardless of the severe shrinkage in market values of securities. Railway earnings in the first week of March were 8.2 per cent larger than in 1906. Leading industries have orders covering production well into the future, especially cotton factories and steel mills, while the output of pig iron when the month opened was close to the largest on record. Traffic conditions improve with the advancing season and constant deliveries of much-needed rolling stock. Money rates are high because of great demands in financing industry and business beyond all precedent. Shipments of currency to the interior are increasing and banks are closely loaned up. Country banks, however, are liberal purchasers of commercial paper, and funds in the crop-producing regions are said to be ample. There is also apparent basis for the idea that liquidation in inflated stocks will allow a more liberal supply of money to be diverted to regular trade channels. *Bradstreet's* reports 186 failures in the United States during the week, against 172 for the previous week, and 187 for the corresponding week of 1906. The Middle States had 53, New England 26, Southern 47, Western 28, Northwestern 14, Pacific 15, and Territories 3. Canada had 23, against 21 for the preceding week. About 84 per cent of the total number of concerns failing had capital of $5,000 or less, and 10 per cent had from $5,000 to $20,000 capital. The domestic copper market was strong, with lake at 26@26⅝c.; electrolytic, 25½@25¾c.; casting, 25½@25⅝c., in large tonnages, between producers and the more important metal merchants and consumers. Copper in stocks of jobbers the country over is obtainable only in small lots and is fetching from 26c. for ordinary to 27c. for prime casting grades.

OUTLOOK FOR ELEVATORS.—Vice-president Comstock of the Otis Elevator Company is quoted by the *Wall Street Journal*, in an interview, as follows: "Last year was the best we ever had, but this year has started off much better. Some of our increases are so big I hate to mention them. Last December some of our directors thought the building situation suggested a recession, and so it did in New York, but not elsewhere. I told them then the outlook had never been better, and I stick to that statement now. Our only trouble is to get copper wire and other materials. The Roeblings, of Trenton, are so pressed with orders they cannot keep a supply of rope cable in Chicago and have to ship from headquarters as ordered. The most extraordinary increase in our business is on the Pacific Coast. This is natural on account of the rebuilding of San Francisco. With this exception the increase is pretty generally distributed over the entire country. I ask everybody I meet how he finds the situation and always receive the same reply: 'All right.' If there is a soft spot anywhere I wish somebody would show it to me. What our companies' net result for 1907 will be will depend largely on the course of prices of the things we must buy. We carry over $10,000,000 in uncompleted contracts all the time, or nearly a year's sales."

STERLING ELECTRIC MOTOR.—The Ohio Foundry Company and the Sterling Electric Motor Company, Dayton, Ohio, under the same control and located in the same plant at State and Wayne Streets, are to move to a new location on Clinton Street, the Miami Canal, Second Street and the alley, where two and one-half acres of ground have been purchased. The buildings to be erected will include a machine shop, 110 ft. x 168 ft., of brick construction, with saw tooth roof, part to be two stories, occupied by the motor department, winding rooms, engineers' offices, etc.; a foundry, 140 ft. x 260 ft., of brick, part two stories, and provided with carpenter shop and pattern room. The Ohio Sterling Railroad Company has been incorporated to build a switch over the canal from the Cincinnati, Hamilton & Dayton Railroad through the full length of the new plant. The directors of the Ohio Foundry Company are: J. A. Gauthier, Joseph F. Wistendorf, Joseph W. Merkle, Charles Krebs and John A. Wessalosky. The officers and directors of the Sterling Electric Motor Company are J. A. Gauthier, president; Ivar Rennerfelt, vice-president, and Joseph F. Wistendorf, secretary and treasurer.

PLANT AT NELSON, B. C.—A test run of an Allis-Chalmers hydraulic turbine generator unit was recently conducted at the city power plant of Nelson, B. C., in the presence of city officials. The unit has a normal capacity of 750 kw, but during the test run this output was increased to 1340 kw for a period of over 45 minutes continuous running without undue increase in temperature of bearings. The usual tests were made as to the heating of the coils and bearings. According to the guarantees, the armature and field coils did not rise in temperature above 35°C. The supply for light and power has been furnished up to the present time by the West Kootenay Power & Light Company, situated just across the Kootenay River from the new city power plant, out of which source both companies derive their power. The hydraulic turbine, which is of standard design, was built at the Scranton, Pa., works of the Allis-Chalmers Company and the generator, which is the vertical type, specially designed for direct connection to hydraulic turbines, was built at the Cincinnati works.

STANLEY ELECTRIC SHOPS.—It is stated that plans have been prepared in the offices of the Stanley Electric Manufacturing Company for the new building which is to be erected on the Wright property, which is located north of the present north-side works. The new building will be 1000 ft. long and 80 ft. wide, three stories high, with basement. It will represent an expenditure of about $300,000. Concrete is to be used in the construction. This building will be used for general manufacturing purposes and will be not only the largest structure in the Stanley group, but one of the largest in that section of Massachusetts. Plans and specifications for the foundry to be erected on the south side of the Boston & Albany Railroad tracks are in the hands of contractors. The building, with equipment, will cost the Stanley Company $200,000, and between 400 and 500 men will be employed therein.

WIRELESS SHIP EQUIPMENTS.—The De Forest system of wireless telegraphy has been placed on the Old Dominion liner "Jefferson," the Clyde Line steamship "Huron," the "Prinz Sigismund" of the Atlas West Indian service of the Hamburg-American Line, and General Manager C. J. Delaney's yacht "Mindora" of the Fisheries Company of Tiverton, R. I. The steamship "La Plata" of the Royal Mail Steam Packet Company left New York last week for Southampton via Kingston, Jamaica, Colon, etc., carrying the De Forest system. She is the first passenger steamer to cross the Atlantic with this American invention. The Royal Mail fleet have been operating the De Forest system for the past year between New York and Colon with very satisfactory results and have arranged to have the system operated on all their boats plying between New York and Southampton.

LUMINOUS ARCS FOR BULLETIN SIGNS.—Mr. C. Johnston Smith, general manager of the M. Wineburgh Advertising Company, 452 Fifth Avenue, has overcome the difficult problem of effectively illuminating bulletin signs by the use of Excello luminous arc lamps. A notable example of such an installation is the large sign at 48 West Thirty-Fourth Street, 25 ft. x 40 ft., which is very efficiently lighted by only two Excello arcs. The sign itself has created considerable attention. It is claimed

that erection and maintenance cost compare very favorably with the use of ordinary incandescent lamps for similar work. The installation was made by the Excello Arc Lamp Company, 24 East Twenty-First Street, New York.

LARGE TROLLEY EXPENDITURES.—Mr. W. Kelsey Schoepf, acting for the Widener-Elkins syndicate, has purchased control of two Indiana trolley systems which will be merged into the Terre Haute, Indianapolis & Eastern. The two roads are the Indianapolis & Western and the Indianapolis & Plainfield. The Widener-Elkins syndicate has let contracts for the completion of their Toledo-Cincinnati trolley line, calling for an expenditure of about $5,000,000.

POWER IN GEORGIA.—It is stated from Atlanta, Ga., that the Albany Power & Manufacturing Company has made arrangements for the development of Porter Shoals on Flint River, two miles north of Albany, and that $1,500,000 will be invested. The energy developed will be used by the Americus & Albany Electric Railway, by cotton mills, and by other enterprises.

PLANT FOR PAPER MILL.—The "Livermore Mill" of the International Paper Company, at Riley, Maine, will add to its generating equipment a 1000-kw Allis-Chalmers alternator of the water-wheel type and exciter. This new unit is wound for 60-cycles, 3-phase, 2300-volts, and will be used on the lighting and power load of the mill.

CALL FOR MOTORS.—Advices from Pittsburg state that the Westinghouse Electric & Manufacturing Company is experiencing an enormous demand for stationary power motors, and is booking orders for such motors at the rate of 3000 a month, of various sizes, chiefly for mill use, and mostly for individual drive.

ORDER FOR AIR BRAKES.—The Allis-Chalmers Company has closed a contract for all air-brake equipments required for all trolley lines owned, leased, operated or controlled by the New York, New Haven & Hartford Railroad Company. The system includes electric railways in about thirty cities.

CINCINNATI POWER PLANT.—The Cincinnati Gas & Electric Company, through the lessee, the Union Gas & Electric Company, has acquired an extensive tract of land on which a big new power plant will be erected, which will cost in the aggregate about $1,500,000.

Financial Intelligence.

THE WEEK IN WALL STREET.—Stocks had a substantial rally at the close of the week from the almost unprecedented demoralization of values in the semi-panicky markets of Wednesday and Thursday. This was in large part due to the fact that the Treasury Department had taken steps to alleviate the strain in the loan market, while covering by the extensive short interest has also been a factor. On Wednesday the weakness of the stock list assumed an acute form. Almost throughout the entire day there was a continual outpouring of great masses of the leading stocks, while new low record prices were made in many instances. In this movement the so-called Harriman group, Union Pacific and its companions, had a conspicuous place. The bears also renewed their activity, and though a feeble rally on covering occurred before the close of Wednesday's market, it did little toward making amends for the previous heavy shrinkage in prices. The absence of any definite rumors of trouble and the fact that the market did not at any time become really panicky was commented on a good deal, and it was also noted that the renewed breaks brought in a certain amount of buying by bargain hunters. On Thursday there was another outbreak of selling, but on Friday better feeling prevailed, and many of the issues which had suffered severely in the previous two days recovered 5 to 10 points. The electric and traction stocks, in sympathy with the demoralization in railroad shares, declined and reached the lowest points for the year, but most of them recovered some of the loss before the close of the week. The curb market suffered a good deal, but the declines were far less severe than in listed stocks because of the smallness of margined accounts. The above are the closing quotations of March 19.

NEW YORK.

	—March—			—March—	
	12.	19.		12.	19.
Allis-Chalmers Co.	12⅞	11	General Electric	151	144
Allis-Chalmers Co. pfd.	32¾	28	Hudson River Tel.	..	..
American Dist. Tel.	..	28	Interborough Met. com.	26⅞	24½
American Locomotive	..	60	Interborough Met. pfd.	61⅞	59¼
Amer. Locomotive pfd.	..	106	Mackay Cos.	70⅜	..
American Tel. & Cable.	80	75	Mackay Cos. pfd.	70	..
American Tel. & Tel.	..	..	Marconi Tel.	..	..
Brooklyn Rapid Transit	60¼	53⅝	Metropolitan St. Ry.	..	..
Electric Boat	32	32	N. Y. & N. J. Tel.	113	..
Electric Boat pfd.	80	80	Western Union Tel.	81	81¼
Electric Vehicle	..	..	Westinghouse com.	150	150
Electric Vehicle pfd.	..	..	Westinghouse pfd.	..	..

BOSTON.

	—March—			—March—	
	12.	19.		12.	19.
American Tel. & Tel.	125	120	Mass. Elec. Ry. pfd.	65	63
Cumberland Telephone.	..	..	Mexican Telephone	..	..
Edison Elec. Illum.	215	215	New England Telephone	118	117
General Electric	..	142	Western Tel. & Tel.	6	6
Mass. Elec. Ry.	17½	17	West. Tel. & Tel. pfd.	..	73

PHILADELPHIA.

	—March—			—March—	
	12.	19.		12.	19.
American Railways	50	49¼	Phila. Electric	8	7⅝
Elec. Co. of America	9¼	9	Phila. Rapid Trans.	19½	17¼
Elec. Storage Battery	55	55	Phila. Traction	..	92
Elec. Storage Bat. pfd.	..	..			

CHICAGO.

	—March—			—March—	
	12.	19.		12.	19.
Chicago City Ry.	150	..	National Carbon	80¼	70
Chicago Edison	..	..	National Carbon pfd.	115	*113
Chicago Subway	..	..	Union Traction	..	..
Chicago Tel. Co.	..	..	Union Traction pfd.	..	..
Metropolitan Elec. com.	23	23			

*Asked.

NEW YORK TELEPHONE MERGER.—Attorney-General Jackson, of New York State, has resumed, this week, the hearing to determine whether the attempt of the United States Independent Telephone Company, of Rochester, to sell out to the Bell Telephone Company is a violation of the anti-trust law of this State. The United States Independent Telephone Company was incorporated in New Jersey, Aug. 25, 1905, to develop and finance the independent telephone business. It was capitalized at $50,000,000. The company controls the New York Independent Telephone Company, which acquired a franchise granted to the Mercantile Electric Company; Utah Independent Telephone Company, Independent Telephone Securities Company, and owns 90 per cent of the stock of the Stromberg-Carlson Telephone Manufacturing Company of Rochester, 98 per cent of the Rochester Telephone Company, and large holdings in the Indianapolis Telephone Company. Before the securities were listed on the Rochester Stock Exchange a premium was paid for them. When they were listed there was a rush to buy and the stock sold at 50¼ and the bonds at 80, but the demand soon began to dwindle. The price started to decline, gradually at first, then more precipitately. Throughout 1906 the reaction continued with only intermittent rallies, and a year after the securities were listed the stock was quoted at 2¾ and the bonds at 13½, a total shrinkage in value of $11,250,000. In the meantime the company's business had suffered a severe setback; irretrievable ruin would be the result. Notes to the amount of $2,500,000 were issued, and this heavy investment of fresh capital temporarily rescued the company, but only postponed the time of reckoning. From time to time more money was supplied until, as George Eastman testified at the hearing, $6,000,000 had been sunk in an effort to place the company on its feet. When it was seen that it was impossible to secure the investment of more capital, the directors and principal bondholders of the company began to consider other ways out of the difficulty. Offers to sell the company to other independent telephone companies were made, but apparently the other companies would make no legitimate bid for the United States Independent Telephone property. Finally, on Jan. 28, 1907, it was announced that an agreement had been entered into looking toward the sale of the United States Independent Telephone Company to the Bell system, the only probable purchaser left in sight.

UNITED STATES STEEL'S ANNUAL REPORT.—The annual report of the United States Steel Corporation, dated March 12, shows that the gross earnings of the corporation in 1906 reached the enormous total of $696,756,926, which is $111,425,190, or 19 per cent, greater than in 1905. Net earnings were $156,624,273, a gain of $36,836,614 over 1905. The year's earnings are far in excess of those of any year in the corporation's history. The hole made in the net earnings by the payment of a 2 per cent dividend on the common stock, calling for a disbursement of $10,166,050, helped to keep the final surplus for the year down to $12,742,859, which is $4,332,955 less than in 1905. Another heavy factor in cutting down the surplus was the great increase in amounts charged for maintenance, renewals and extraordinary replacements, which totaled $48,333,089, an amount 29 per cent in excess of 1905. The surplus net income

for the year amounted to $62,742,859, against $43,365,815 in 1905. Offsetting this large gain is the appropriation of $21,500,000 for the Gary plant in Indiana and $28,500,000 set aside for additional property construction, and the discharge of capital obligations. These two items exceed last year's appropriations by $23,700,000. Another index of the enormous strides taken by the steel industry during 1906 is the increase of 22,299 in the corporation's employees, who now total 202,457, and draw an annual wage of $147,765,540. E. H. Gary, chairman of the Board of Directors, comments in his report on the constantly growing demand for steel. The average price received by the corporation for its products last year was 5.3 per cent greater than in 1905, and about 8 per cent lower than the high prices of 1902. The report makes this reference to conditions since the first of the year: "Since Jan. 1, 1907, the orders received have been somewhat less than they were during the months immediately preceding that date, but they are larger than they were during the same months of 1906, and have about equaled the productive capacity of the mills, notwithstanding the tonnage of unfilled orders on the books at the close of the year equaled 8,489,718 tons of all kinds of manufactured steel and iron products, in comparison with 7,605,086 tons at the close of 1905."

UNION SWITCH & SIGNAL.—The annual meeting of the stockholders of the Union Switch & Signal Company was held last week. Col. H. G. Prout, vice-president and general manager, acted as chairman. The financial report for the last fiscal year, which was published some three weeks ago, having been read and approved, the following directors were elected: Geo. Westinghouse, Robert Pitcairn, William McConway, Geo. C. Smith, Thos. Rodd, H. G. Prout and John B. Jackson, 32,942 shares being voted at the meeting. The directors re-elected Mr. Westinghouse president. It was announced that the 5000 shares of new stock had already been subscribed for. In addition, it was stated that the outlook for business during the coming year was exceedingly favorable, that the company at the present time has $2,000,000 worth of unfinished orders in the shops, and that owing to the great increase in business during the last few years it has become necessary to provide additional manufacturing facilities and to this end an addition to the factory adjoining the present location is now being erected. The statement of the Union Switch & Signal directors, showing a gross business of $5,065,175, an outstanding capitalization of $2,250,000 and profits of $1,055,332, amounting to nearly 45 per cent on the issued capital, was received with much satisfaction. Coincidently with the sending out of the notice of the annual meeting, the shareholders had been offered the right to subscribe on or before the 12th of March for 5000 new shares at a premium of 60 per cent, that is, at $80 per $50 share, the entire amount of which was taken by shareholders, thereby raising the capitalization to $2,500,000. The outstanding stock has been selling at $75 per $50 share.

DIVIDENDS.—The directors of the Electric Boat Company have declared the regular quarterly dividend of 2 per cent on the preferred stock, payable April 1. The directors of the Union Switch & Signal Company have declared the regular quarterly dividend of 3 per cent on the common and preferred stocks, payable April 10. The Western Union Telegraph Company has declared the regular quarterly dividend of 1¼ per cent, payable April 15. The directors of the Electric Storage Battery Company have declared the regular quarterly dividend of 1¼ per cent on both common and preferred stocks, payable April 1. The United Traction & Electric Company has declared a regular quarterly dividend of 1¼ per cent, payable April 1. Directors of the United Gas Improvement Company have declared the regular quarterly dividend of 2 per cent, payable April 15. The guaranteed quarterly dividend of 1¾ per cent on Manhattan Railway will be paid April 1. The directors of the New Orleans Railway & Light Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable April 15. Directors of the Cincinnati Gas & Electric Company have declared the regular quarterly dividend of 1⅛ per cent, payable April 1. Directors of the Cincinnati Street Railway Company have declared the regular dividend of 1½ per cent, payable April 1. The directors of the American Cities Railway & Light Company have declared a quarterly dividend of 1½ per cent on the preferred stock, payable April 1 to stockholders of record March 21. On Jan. 1, 1907, the company paid an initial dividend of 3 per cent. The Bell Telephone Company of Canada has declared a regular quarterly dividend of 2 per cent, payable April 15.

HIDALGO ELECTRIC REPORT.—The State of Hidalgo Electric & Traction Company, Mexico, has made its annual report. The capital has been increased from $2,000,000 to $3,000,000 for enlargement of plant. Of the company's disposable power, 350 hp are used for lighting the city of Pachuca. During the year 1906 the horse-power added to the original 1,616 was 612 and 300 more is ready to be connected; this is without including the power for the Real del Monte Company. The revenues during 1906 amounted to $327,945.52 and consisted of: Products from power, $168,060.33; from lights, $82,664.13; from irrigation, $77,221.06; total, $327,945.52. The expenses in 1906 were $91,579.09. The general balance on December 31 showed the sum of $3,788,886.15, as representing the total turnover of the company's business in the year. Dividends of 8 per cent for the year have been paid.

COLORADO TELEPHONE REPORT.—The Colorado Telephone Company, the Bell system, has issued its annual report for the year ended January 31, 1907:

	1906.	1905.	1904.	1903.
Gross	$2,097,706	$1,793,526	$1,497,350	$1,294,837
Expenses net	1,656,173	1,397,093	1,118,196	977,733
Net	$441,535	$396,433	$379,154	$317,104

Maintenance expenditures during the year amounted to $477,686. Expenditures aggregated for the 12 months, $2,053,990, which was partially financed by the issuance of $1,555,600 new stock. Stations on December 31 numbered 54,895, an increase of 9,150, or 20 per cent, during the year. The company added 21,716 miles of toll wire and 11,261 miles of exchange line in the same period.

KANSAS CITY EARNINGS.—The Kansas City Railway & Light's report for January, 1907, and eight months to January 31, 1907, is as follows:

	1907.	1906.		
January gross	$478,021	$427,330	Inc.	$51,691
Expenses	238,017	213,976	Inc.	24,041
January net	241,004	$213,354	Inc.	$27,650
Taxes and interest	147,519	136,289	Inc.	11,230
January surplus	$93,485	$77,065	Inc.	$16,420
Eight months gross	3,851,642	3,471,368	Inc.	380,274
Expenses	1,896,740	1,688,557	Inc.	208,183
Eight months net	$1,954,902	$1,782,811	Inc.	$172,091
Taxes and interest	1,165,135	1,095,186	Inc.	69,949
Eight months surplus	$789,767	$687,625	Inc.	$102,142

KEYSTONE TELEPHONE EARNINGS.—The Keystone Telephone Company, of Philadelphia (combined independent companies), reports for January and seven months as follows:

	1907.	1906.		
January gross	$83,842	$67,345	Inc.	$16,497
Expenses and taxes	43,431	39,262	Inc.	4,169
January net	$40,411	$28,083	Inc.	$12,328
Seven months gross	543,186	467,509	Inc.	75,677
Expenses and taxes	294,298	255,703	Inc.	38,595
Seven months net	$248,888	$211,806	Inc.	$37,082

HUDSON RIVER POWER.—The Hudson River Electric Power Company reports earnings for January and twelve months ended January 31, 1907, as follows:

	1907.	1906.		
January gross	$96,892	$76,038	Inc.	$20,854
Expenses	50,839	35,821	Inc.	15,018
January net	$46,053	$40,217	Inc.	$5,836
12 months gross	917,684	754,642	Inc.	163,042
Expenses	537,553	412,824	Inc.	124,734
12 months net	$380,126	$341,818	Inc	$38,308

AUTOMATIC TELEPHONE.—The Automatic Electric Co., of Chicago, which manufactures automatic telephones, had on its books on January 1 of this year $7,000,000 of unfilled business. Since then it has added $2,000,000 additional to its books, and $1,800,000 of new business is pending. The gross business of the Automatic Electric Co. in 1906 was double that of the preceding year.

GENERAL ELECTRIC EARNINGS.—The annual report of the General Electric Company will show net earnings of nearly $11,000,000, a total surplus of approximately $17,500,000 and a gross business for the year of nearly $60,000,000. The fiscal year of the company ended on Jan. 31 last. Current earnings since that period have been at least 20 per cent in excess of last year.

DOMINION POWER BONDS.—N. W. Harris & Company have purchased $1,650,000 5 per cent bonds of the Dominion Power & Transmission Company of Hamilton, Ont., which now owns and controls the electric light, power and street and interurban railway business there.

GENERAL NEWS.

Construction News.

BIRMINGHAM, ALA.—J. M. Dewberry, president of the Tidewater Development Company, states that contracts for the construction of the proposed electric line from Gadsden to Tuscaloosa via Birmingham will be let within two or three months.

SELMA, ALA.—The Selma Street & Suburban Railway Company is preparing to extend its lines in the near future. F. M. Abbott is president.

DEVALL BLUFF, ARK.—J. W. Baxter, of Fayetteville, and associates are contemplating developing the water power of White River and transmitting the electricity for operating railways, lighting and power plants and manufacturing industries. The company proposes to develop from 15,000 to 20,000-hp. A company will be incorporated and organized to build the railway and power plants with a capital of $150,000. J. T. Evins, of Fayetteville, and J. C. Bonnell, of St. Louis, Mo., are interested.

LAKE VILLAGE, ARK.—The City Council has decided to establish an improvement district, for the construction of water works and an electric light plant.

EUREKA, CAL.—R. W. and E. W. Skinner are planning to erect a single mill and have made arrangements with the North Mountain Power Company to furnish electricity to operate the mill. A 50-hp motor will be installed as soon as the mill is erected.

FRESNO, CAL.—R. W. Thomas, William Snyder, H. E. Woodward and F. S. McKee have filed claims for water rights on the Kings River, asserting that they plan to develop power for transmission over the Sierra Nevadas to Death Valley and the mining districts about Bullfrog in Nevada.

LOS ANGELES, CAL.—The City Council has granted an application for the sale of a street railway franchise. As none of the local railway companies will build this line under a twenty-one year franchise, property owners in the district will bear the expense of construction by popular subscription. Robert Marsh made the application for the franchise.

LOS ANGELES, CAL.—Work has commenced on the construction of the Los Angeles aqueduct. Plans for boat and machinery have been made and bids are being advertised for supplying the machinery. The dredging machine consists of a cutter, a centrifugal pump and three motors. Power will be developed on Division Creek for operating the dredge and lighting the works by laying 5100 feet of 12-in. pipe and installing a Pelton wheel and the electrical machinery required to furnish to 200-hp. Engineer Mullholland estimates the total cost of power plant, dredger, and lighting system at $17,500.

MEADOWS, CAL.—B. A. Chisholm and E. Goodman propose putting in an electric power plant at the falls of the Little Salmon, 16 miles below here. The power is to be used for electric lighting and other purposes in this valley.

OROVILLE, CAL.—J. W. Goodwin and associates have recently purchased a large interest in the Cataract Gold Mining & Power Company. The head office will hereafter be in San Francisco. Through this purchase Mr. Goodwin and associates have secured the control of the the power site on the North Fork of the Feather River, where it is said that a large reservoir will be built to store water for power purposes.

SAN DIEGO, CAL.—A franchise has been granted to the San Diego & Arizona Railway Company by the City Council.

STOCKTON, CAL.—The American River Power Company has purchased a site in this city on which it will erect a power station, which will be used as an auxiliary to the main plant.

TULARE, CAL.—Clarence M. Smith, of San Francisco, has purchased the property of the Consolidated Heat, Light & Power Company in this city. Mr. Smith states that improvements will soon be made to the plant.

COLORADO SPRINGS, COL.—The City Council has passed an ordinance providing for a vote of the taxpayers on the question of issuing bonds not to exceed $150,000 for the purchase or construction of a municipal electric lighting plant.

HOLLY, COL.—The Holly Sugar Company is considering the construction of water works and an electric light plant, if the Town Council will grant a franchise. The probable cost is placed at $40,000.

PALISADES, COL.—B. O. Smith, of Milwaukee, Wis., has purchased the electric lighting plant in this town for a consideration of $20,000. The new owner will make extensive improvements to the plant.

MILFORD, CONN.—Langner & Company are now installing a gasoline engine and dynamo to furnish electricity to operate the machinery in its plant.

SUFFIELD, CONN.—The Consolidated Railway Company has secured the right of way from Springfield to its power house in the town of Mapleton and will extend its transmission lines to the power house, which will be operated by electricity from the main power plant in Springfield. The use of the equipment in the Mapleton power house will be discontinued.

WINSTED, CONN.—A 200-hp engine has been installed at the power house of the Torrington & Winchester Street Railway Company at Burrville, making three engines in commission there.

JACKSONVILLE, FLA.—The Jacksonville Electric Company has been granted a franchise for extensions of its lines in various sections in the city.

JACKSONVILLE, FLA.—A franchise has been granted to J. Craig Phillips, James N. Holmes and C. B. Ware by the Hillsborough County Commissioners for an electric railway line from this city to St. Petersburg and Clearwater. It is not yet determined whether the road will be started as an electric road or an automobile system.

ST. AUGUSTINE, FLA.—The City Council has authorized the finance committee to investigate the cost of installing an electric light plant to furnish light and power to the entire city.

ATLANTA, GA.—The Bibb Power Company, Macon, Ga., has effected reorganization and applied for authority to increase its capital stock from $100,000 to $5,000,000 and proposes to develop 50-000-hp at plants on the Oconee, Ocmulgee and Flint rivers to furnish electric energy to operate the Macon & Albany and Atlanta & Macon interurban railways. It is announced that construction work will begin in the early summer upon a power plant on Little River that will represent when completed a total investment of $2,000,000. The officers of the company are: W. J. Massee, of Macon, president; J. C. Walker, of Marshalville, vice-president; John T. Moore, of Macon, treasurer; M. Felton Hatcher, of Macon, secretary; J. L. Anderson, of Marietta, assistant secretary and treasurer; Charles F. Howe, of Milledgeville, chief engineer, and Walter T. Johnson, of Macon, general counsel. Lockwood, Greene & Company, of Boston, Mass., have been engaged to construct the plants.

COLUMBUS, GA.—An ordinance was introduced on March 7 calling for an election on July 11 to vote on the proposition of issuing $100,000 for the purpose of building a municipal lighting plant.

CHICAGO, ILL.—The Metropolitan Elevated Railway has petitioned for a franchise to extend its line to Cicero.

CHICAGO, ILL.—The Consolidated Gas & Electric Company has been chartered with a capital stock of $2,500 by Samuel Buffington and others.

EAST ST. LOUIS, ILL.—The East St. Louis & Suburban Railway Company has been granted a franchise to operate its lines on several streets in the city.

PEORIA, ILL.—The Peoria Railway Company has been granted a franchise on Nevada and Oregon Streets. S. L. Nelson is manager.

ROCKFORD, ILL.—The construction of an electric railway to connect Rockford, Byron, Oregon, Dixon and other cities and towns in the Rock River Valley is now under consideration. The proposed line will be known as the Rockford, Oregon & Southern, and the proposition covers the territory between Rockford and Dixon, taking in the power plant at Oregon and the construction of a new concrete dam. F. G. Jones, of this place, is interested in the project.

BROOKVILLE, IND.—The City Council is soliciting competitive bids for electric light for the city. A Cincinnati company has asked for a 20-year franchise, agreeing to furnish the city with light at $63.50 per lamp per year for a period of five years. There is a strong sentiment for municipal lighting, the system to be operated in connection with the water works. The Council, however, is opposed to a municipal plant.

EVANSVILLE, IND.—The Evansville & Henderson Traction Company has filed an application for a 50-year franchise to operate its line in this city.

FORT WAYNE, IND.—The new Spy Run power station of the Fort Wayne & Wabash Valley Traction Company has been put in operation and is now furnishing electric energy for operating the entire system. The Boyd Park plant is being dismantled and equipment of the station is being sold. A small sub-station will be maintained at the Boyd Park plant.

GREENSBURG, IND.—Seven telephone companies doing business in the southern part of Ripley County have been consolidated under one management, and Perry F. Brown, of Napoleon, is president and manager of the consolidated company. Mr. Brown has arranged to connect with the Greensburg Telephone Company, through which he also secures long-distance connection for the patrons of the consolidated company.

INDIANAPOLIS, IND.—Vonegut & Bohn, architects, are preparing plans and specifications for the erection and equipment of a power house and lighting plant for the new Methodist hospital in this city. Bids for this work will be asked for in a short time.

INDIANAPOLIS, IND.—Bids will be received until April 5 by the Board of County Commissioners for new boilers, pumps, heater and necessary pipe work for the county power house. John S. McGaughey is chairman.

MOROCCO, IND.—W. B. Harpole, owner of the electric light plant, is contemplating installing a new engine in the power house.

SEYMOUR, IND.—The Seymour Gas & Electric Light plant is advertised to be sold at sheriff's sale on March 23 to satisfy a judgment for $21,000. The plant is appraised at $30,000 and said to be worth at least $55,000. The plant is owned by Chicago parties.

SOUTH BEND, IND.—Extensive improvements and extensions are contemplated in the local street railway system by the directors of the Chicago, South Bend & Northern Railway Company. More than $1,000,000 has been appropriated for the work to be done in this city.

WESTFIELD, IND.—Messrs. Hinshaw & McKnight are contemplating the installation of an electric light plant to furnish electricity for lighting the town.

AFTON, I. T.—T. M. Reynolds, of Afton, secretary and treasurer of the Cherokee Power Company, writes that the proposed plant will cost about $1,000,000. S. M. McKee, of Joplin, Mo., is the engineer.

DUNCAN, I. T.—W. S. Andrews has applied to the town authorities for a franchise to construct and operate an electric railway in this place.

DAVENPORT, IA.—Bachr & Von Maur, of St. Louis, Mo., are the engineers who have charge of the work contemplated by the Independent Power & Lighting Company. The company has secured a site for its plant.

MUSCATINE, IA.—The Muscatine Clay & Tile Company is planning to construct and operate an electric railway for the purpose of transporting clay and clay products. B. F. Primer is president.

PELLA, IA.—The proposition to issue $70,000 bonds to establish a municipal light plant and to extend the water works system to the river was defeated at an election March 5.

SIDNEY, IA.—The citizens will vote March 25 on the proposition to grant a franchise to the City Telephone Company.

LEAVENWORTH, KAN.—Fire destroyed the plant of the People's Home Telephone Company, causing a loss of $30,000.

TOPEKA, KAN.—At the city election to be held April 12, the citizens will be asked to vote on the proposition to issue $40,000 in bonds for the reconstruction of the city electric light plant.

ELIZABETH, KY.—C. J. Lampton has commenced surveying a route for an electric railway between this city and West Point, a distance of twenty-two miles. The cost of construction is estimated at between $10,000 and $12,000 per mile.

LEXINGTON, KY.—The Lexington Railway Company is contemplating extensive improvements and reconstructing its lines, the cost of which is estimated at $200,000.

LOUISVILLE, KY.—The stockholders of the Louisville Traction Company will hold a meeting April 13 to vote on the proposition of increasing the capital stock of the company from $12,000,000 to $15,000,000.

MURRAY, KY.—The City Clerk writes that the proposed water works and electric light plant will cost about $20,000. An engineer has not yet been selected.

HOUMA, LA.—The Board of Aldermen has passed an ordinance providing for the issue of $30,000 bonds for municipal water works and electric light plant.

NAPOLEONVILLE, LA.—The municipal electric lighting plant, recently erected at a cost of $15,000, is now in operation and giving service at 15 cents per kw-hour, or 50 cents per month per lamp. The plant has a capacity of twenty street arcs and 1000 incandescent lamps, and is equipped with two dynamos and a Chuse engine.

BALTIMORE, MD.—The United Railways & Electric Company has under consideration the building of an auxiliary power station to serve its Bay Shore Park line and to provide electric power for the east water front connections. The new power plant will also furnish electricity for lighting at Bay Shore Park. The cost of the work is estimated at about $100,000.

MIDLAND, MD.—The Consolidated Coal Company has ordered for the Midland Electric Lighting Company a 2200-volt alternating-current dynamo from the Westinghouse Electric Company. The company will erect a brick building in place of the one recently destroyed by fire. It will also install two more boilers of 80-hp each, thus increasing the capacity of the plant to 800-hp.

FRAMINGHAM, MASS.—At a recent meeting it was voted to appropriate $9,000 for lighting the streets and buildings, and the Selectmen were authorized to enter into a contract with the Edison Illuminating Company to furnish street lighting until April 1, 1908. By the terms of the contract the company is to furnish incandescent lamps at 32-cp up to 400 to $15 per lamp per year, and all above 400 at $13 per lamp. The town now uses 450 lamps. The price for arc lamps is $65 per lamp per year.

LOWELL, MASS.—The Hamilton Manufacturing Company is contemplating building a new power house and coal pocket on Jackson street at a cost of $150,000. Westinghouse, Church, Kerr & Company, of New York, are the engineers.

PALMER, MASS.—It is announced that the New York, New Haven & Hartford Railroad Company has secured control of the Palmer Electric Light Company, through the New England Investment & Security Company. The transaction was completed when the old board of directors resigned and a new board consisting of directors of the New Haven road were elected. In taking over the company it was reorganized with the name of the Central Massachusetts Electric Light Company. It has franchises to supply Palmer and other nearby towns with the electricity, and it also furnishes the power for the operation of the Springfield & Eastern Railway, which is owned by the New York, New Haven & Hartford Railroad Company.

PEABODY, MASS.—Charles A. Southwick, of Peabody, has proposed that Peabody and Danvers unite in establishing a lighting plant at tide water at Danversport.

SPRINGFIELD, MASS.—The Springfield Street Railway Company has been granted permission by the State Railroad Commission to issue 3000 shares of additional stock. The proceeds will be used in retiring $310,000 of floating indebtedness for property improvements and in carrying out improvements already decided upon. The company is contemplating an expenditure of $250,000 on the Margaret Street power house, including a new 2000-kw generator, new feed wires for the Belmont Avenue, Chicopee and Indian Orchard lines, and $25,000 for a new telephone system. Plans are now under consideration for still further improvements of the electric railway service.

AUGUSTA, MICH.—At an election held March 15 the citizens voted to install an electric street lighting system. Electricity will be purchased from the Commonwealth Power Company.

CRYSTAL FALLS, MICH.—About $20,000 will be expended for improvements at the municipal electric light plant.

ESCANABA, MICH.—Sealed proposals will be received at the office of the Board of Public Works until March 23 for furnishing all material and work for repairs and improvements to be made to the municipal electric lighting plant.

HOLLAND, MICH.—The Board of Public Works is contemplating enlarging the electric light plant at an estimated cost of $30,000.

TRAVERSE CITY, MICH.—George Brownell, of Plainwell, has purchased an interest in the Electric Land & Development Company. Mr. Brownell will become the electrician of the company.

DULUTH, MINN.—The Duluth, Messabe & Northern Railway Company has awarded a contract to the Barnett & Record Company for the construction of a coal dock on its property immediately east of Ore Dock No. 1 at West Duluth. The equipment will be operated entirely by electricity, which will be furnished by the Great Northern Power Company of Duluth. Work will begin immediately and the dock will be ready to receive coal on or before Aug. 1.

GLENCOE, MINN.—The Glencoe Light & Power Company is planning to rebuild its system, according to plans made by E. E. Rines, of Minneapolis.

MANKATO, MINN.—The City Council is now considering an ordinance granting a franchise to W. L. Hixon and H. E. Hance to operate an electric street railway franchise within the city limits and a lighting and steam or hot water heating plant.

MINNEAPOLIS, MINN.—C. S. Cairns, attorney for Webster Brothers, is preparing a franchise to present to the City Council, asking for authority to construct an electric light plant for the purpose of furnishing electricity in Minneapolis at reduced rates.

MINNEAPOLIS, MINN.—The City Council on March 8 revoked the five ordinances on which the Minneapolis General Electric Company for years claimed its franchise rights to do business in this city. The company is permitted the use of the streets until Jan. 1, 1908, and must secure a franchise from the city before that time or go out of business.

JACKSON, MISS.—The Jackson Electric Light Power & Street Railway Company is planning to build a line up North Jefferson Street to Fortification and possibly to Belhaven, and is also contemplating the Gallatin Street extension.

YAZOO CITY, MISS.—The City Council has awarded the contract for the construction and equipping of the city street railway to Saunders-Johnson Company, of Vicksburg. The road is over three miles in length and will cost $50,000.

BELLEVILLE, MO.—The St. Clair County Farmers' Mutual Telephone Company has purchased the plant and system of the Millstadt Telephone Company in Millstadt.

BITTER CREEK, MO.—The Bitter Creek Mutual Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are: H. J. Whipple, R. P. Kern and F. Carmichel.

CEDARDALE, MO.—The Estella, Cedardale & Quinlin Telephone Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are Charles Johns and Milo Smith, of Driskoll, Charles Shepard, of Cedardale, and M. C. Kelley, of Estella.

CENTRALIA, MO.—The citizens have voted in favor of issuing $50.000 bonds for water works and $15,000 bonds for an electric light plant.

KANSAS CITY, MO.—Bids will be received until March 29 by the Board of Public Works for general steam heating and ventilating of the General Hospital; also for the following special equipment: Boilers, automatic heat regulation, refrigeration and electrical equipment. Everett Elliott is secretary.

SHATTUCK, MO.—The Farmers' Mutual Rural Telephone Company has been incorporated with a capital stock of $1,500. The incorporators are T. J. Eldredge, William Holmes, McHenry Smith and Charles Taylor

SALTESE, MONT.—Arrangements are being made for the installation of an electric light and water works plant in this town.

OMAHA, NEB.—The Omaha Independent Telephone Company will place all of its wires underground throughout the city.

ASBURY PARK, N. J.—The Atlantic Coast Electric Light Company has announced that beginning with June 1 the price of electricity will be reduced to 18 cents per kw-hour with a discount for prompt payment. S. F. Hazelrigg, president of the Atlantic Coast Electric Light Company, has placed contracts for a new power station equipped with turbine condensing apparatus, with double the capacity of the present plant. As the new machinery will not be in position in time for service the coming season, additional machinery will be placed temporarily in the power plant of the Allenhurst Railway to meet the demands until the new plant is in operation.

BELVIDERE, N. J.—The Hudson River Power Company is contemplating the erection of a power plant of 30,000-hp on the Delaware River between Belvidere and Foul Rift.

JERSEY CITY, N. J.—The Allendale Electric Company has been incorporated with a capital stock of $100,000 by Frank G. Smith, John Milton and Benjamin Treacy.

NEWARK, N. J.—The Common Council on March 12 adopted the recommendations made to the special committee of the Council in charge of the lighting plant for the new city hall for the installation of an electric lighting plant to cost, with switchboard and wiring complete, about $25,000, with two generators of 100-kw capacity and one of 50-kw capacity.

NEWARK, N. J.—Frederick O. Runyon, who has been the city's engineer expert in the investigation of municipal ownership of electric light plants, submitted to the Board of Works on March 14 a supplement to his report on the cost of constructing and maintaining a municipal plant, showing the effect of the new "magnetite" street arc lamp in reducing the cost of street lighting. Mr. Runyon demonstrated that the average cost per arc lamp with the "magnetite" lamp in use, and service from a municipal plant for a ten-year period, would be $59.67, as against $65.22, the estimate with the present type of lamp, and $70, the rate offered by the Public Service Corporation. The supplementary report was ordered by the board, because President Thomas N. McCarter, of the Public Service Corporation, in making an offer recently to make a new contract, beginning September 1, 1908, at a rate of $70 per lamp a year, declared the company was enabled to make that rate because of the "magnetite" lamp. The city now pays $95 per arc light a year.

ROSWELL, N. M.—The Roswell Electric Light Company is now installing in its plant a 300-kw General Electric alternator, 375-hp Vilter Corliss engine and a 175-hp Springfield internal furnace, boiler and accessories.

ALBANY, N. Y.—Application has been made by the Buffalo & Lake Erie Traction Company to the Board of State Railroad Commissioners for authority to increase its capital stock from $6,750,000 to $7,500,000. The purpose of the increase is to purchase the stock of the Jamestown Chautauqua & Lake Erie Railway. The company is building a continuous line from Erie to Buffalo.

BABYLON, L. I., N. Y.—The Babylon Electric Light Company has decided to amend its charter in order to permit the manufacture of gas for use in Islip and Bay Shore. The company also proposes rebuilding its plant and constructing a new fireproof station.

BUFFALO, N. Y.—The Buffalo Southern Railway has been granted a franchise to build an electric railway from East Aurora to connect with the Hamburg line.

COHOES, N. Y.—A franchise has been granted by the City Council to the Hudson River Electric Company to furnish electricity for lighting purposes in this city. The company agrees to furnish electricity at a maximum charge of eight cents per kw-hour and also to furnish free of charge electric energy for lighting the city hall and various fire houses throughout the city. All of the wires of the company are to be placed in underground conduits.

LOCKPORT, N. Y.—It is reported that the Westinghouse interests are to provide the electrical equipment for the plant that will be erected by the Ontario Power Company near Lockport, with the New York Central Railroad as a third party. The plant is to be built on the Ernest farm, two miles from Lockport, on which is located the power station of the Niagara, Lockport & Ontario Power Company.

ROCHESTER, N. Y.—The Appellate Division of the Supreme Court on March 6 handed down a decision in which the State Railroad Commission is ordered to grant a certificate of convenience and necessity to the Rochester & Southern Construction Company to build a road from Rochester, Corning, Elmira and other southern points, which certificate had been previously denied by the commission.

ROME, N. Y.—The Board of Public Works has appointed Chairman White and Clerk Midlam as a committee, to visit nearby cities and ascertain forms of contracts for street lighting, etc., with a view to asking for bids for the new lighting contract.

SYRACUSE, N. Y.—The Syracuse & Milford Railway Company has filed articles of incorporation with the Secretary of State to build a railway to run from Syracuse to Milford, a distance of twelve miles.

SYRACUSE, N. Y.—The Syracuse Lighting Company has abandoned its fight against the reduction in gas and electricity rates ordered by the State Commission of Gas and Electricity. The order of the State fixes the price of electricity at nine cents per kw-hour until Oct. 1, 1907, and eight cents per kw-hour thereafter, and $68 per street arc lamp per year. It also refixes a standard of service for gas, requires an improved system for the inspection of arc lamps and establishes a classified schedule of rates for electric energy for light, heat and power. It is stated that the company will not renew the effort to lease its property of the United Gas Improvement Company, of Philadelphia, Pa. The company will take steps immediately, it is said, to make improvements to its system.

TROY, N. Y.—The managers of the municipal electric lighting plant are considering overhauling all of the lines next summer.

UTICA, N. Y.—Notice has been given by the Hudson River Electric Power Company that the local offices will be given up and that after April 1 the business will be transacted at the Glens Falls office.

FAYETTEVILLE. N. C.—The Legislature has passed a bill permitting the town of Fayetteville to sell or lease its electric light plant on contract. A bill was also passed amending the charter of the Yadkin Development & Power Company.

STATESVILLE, N. C.—The town has placed contracts with the Westinghouse Company and with the General Electric Company for an outfit for the transformer stations to be erected in accordance with a contract with the Southern Power Company, which is to deliver electric energy in the town by June 1.

ALLIANCE, OHIO.—The Alliance Gas & Electric Company is contemplating rebuilding its plant the coming year. D. W. Low is superintendent.

ATHENS, OHIO.—Bids will be received until March 25 by W. B. Golden, Village Clerk, for $6,000 electric light bonds.

BLANCHESTER, OHIO.—The citizens are contemplating extending the lines of the municipal electric lighting plant and installing 40 new street lamps. A. E. Doughman is superintendent.

BUCYRUS, OHIO.—The capital stock of the Bucyrus Telephone Company has been increased from $60,000 to $100,000.

BURTON, OHIO.—E. C. Bliss, owner of the Burton electric light plant, is contemplating installing a 50-hp tubular boiler, stack, etc.

CANTON, OHIO.—The Central Heating & Lighting Company has made application to the City Council for a franchise to install and maintain a plant in this city.

CEDARVILLE, OHIO.—A new boiler will be installed in the Cedarville electric light plant this spring. E. G. Lewry is owner and manager.

CHICAGO JUNCTION, OHIO—The managers of the municipal electric light plant are contemplating installing a day service this summer. Meters will be installed. F. A. Moody is chief electrician.

CINCINNATI, OHIO.—The State Board of Public Works has signed a lease with the Union Gas & Electric Company, of Cincinnati, providing for the company to build and maintain a pole line on the berme bank of the Miami & Erie canal from Cincinnati to Glendale, a distance of 12 miles. A protest against the lease was made from Cincinnati, as the citizens desired to plant trees along that portion of the canal within the city in order to beautify it. The Attorney General has refused to approve the lease until he allows a hearing on the protest. Both the Attorney General and Governor must approve the lease before it becomes valid.

COLLINWOOD, OHIO.—The citizens are contemplating installing a 350 to 400-kw alternating-current, 3-phase generator in the municipal electric lighting plant, to be in operation by May 30. C. G. Beckwith is manager.

COLUMBIANA, OHIO.—The citizens are contemplating establishing a day service and expect to install an 85-hp gas engine and an alternating-current generator of 50-kw capacity in the municipal electric light plant.

COLUMBUS, OHIO.—Bids will be opened on March 28 by the Board of Public Service for furnishing material and installing additional machinery for the municipal electric light plant as follows: One high pressure condensing steam turbine of ample capacity and adapted for driving a direct-connected generator of a rated capacity of 1,000-kw under normal load condition; one 1000-kw turbine type alternator; one exerter set; one 1000-kw surface condenser and accessories; two 300-hp water tube boilers with super-heater; stokers for two 300-hp water tube boilers with the necessary actuating power and machinery; steel coal bins over two 300-hp boilers with capacity of 100 tons; fuel economizers for two 300-hp water tube boilers; additional switchboard for 1,000-kw alternator and exciter; 300 arc lamps of a rated capacity of 2000-cp each; 6000 ft. 3/8-in. steel rod for mast arms; 5000 ft. 1¼-in. steel pipe for mast arms; extension to switchboard gallery 11 ft. 6-in. wide x 9 ft. long. Edward F. McGuire is secretary of the board.

CONNEAT, OHIO.—About $2,000 will be spent on repairing the lines of the municipal electric lighting plant the coming year. J. K. Henderson is superintendent.

DAYTON, OHIO.—The Dayton Lighting Company is planning to double the capacity of its plant within the next year. F. M. Tait is manager.

ELYRIA, OHIO.—The City Council has adopted the electric lighting specifications and has authorized the board to advertise for bids for lighting the city.

GRAND RAPIDS, OHIO.—The installation of a new water wheel is being contemplated by the Pilliod Light & Power Company. Frank Heising is manager.

GREENVILLE, OHIO.—The Greenville Electric Light & Power Company is planning to install a new boiler in its plant this year. S. M. Rust is superintendent.

HARRISON, OHIO.—The Provident Savings Bank & Trust Company has instituted suit of foreclosure against the Harrison Water & Light Company and Victor T. Chambers, receiver of the company.

HICKSVILLE, OHIO.—C. L. Lott, president of the Hicksville Electric Light Company, writes that the company expects to install a 100-hp boiler in its plant.

HURON, OHIO.—The Warren Electric Manufacturing Company has been awarded the contract for the new generator for the municipal electric lighting plant.

HURON, OHIO.—The citizens are considering the question of increasing the capacity of the municipal electric lighting plant and contemplating the installation of a 65-hp engine and a generator of 45-kw capacity. J. C. Britton is chief engineer.

LORAIN, OHIO.—The Citizens' Gas & Electric Company is contemplating extensions and improvements to its plant and will install a 200-kw, three-phase, 60-cycle, 2000-volt alternator and gas engine with switchboard and station equipment, and also 15 new street arc lamps. William M. Adams is manager.

MINERVA, OHIO.—A new outfit of engines and dynamos is now under consideration for the municipal electric lighting plant. Willard Pennock is superintendent.

MT. VERNON, OHIO.—J. Dover of this place is interested in the construction of an electric railway from Wooster to Mt. Vernon.

ORRVILLE, OHIO.—The Orrville Light, Heat & Power Company is contemplating extending its lines 1¼ miles, and will also extend its lines to West Market, a distance of one mile. H. W. Enck is manager.

SABINA, OHIO.—The rebuilding of the pole lines of the municipal electric light plant is now under consideration. C. W. Morrow is manager.

ST. CLAIRSVILLE, OHIO.—We are informed that the lines of the municipal electric light plant will be entirely rebuilt next summer.

STEUBENVILLE, OHIO.—The La Belle Iron Works has under consideration installation of 200-hp alternating-current motors and 300-hp direct-current motors. W. D. Crawford is manager.

STEUBENVILLE, OHIO.—The Steubenville Traction & Light Company is contemplating extending its lines seven and one-half miles to connect with the East Liverpool Traction & Light Company. J. C. Rothery is manager.

VERSAILLES, OHIO.—Extensive additions and improvements are to be made to the municipal electric lighting plant and orders for machinery have been placed as follows: One 125-kw, direct-current Fort Wayne generator, one 185-hp Skinner engine. A Brownell boiler of 125-hp has recently been installed. J. F. Herbert is manager.

WAPAKONETA, OHIO.—A 200-hp water tube boiler will soon be purchased for the municipal electric light plant. Albert Francke is superintendent.

BANDON, ORE.—Edwin G. Ames and Hollopeter Brothers have secured a contract for the establishment of a light and power plant at Bandon.

PORTLAND, ORE.—Harriman interests, who recently purchased the Corvallis & Eastern Railroad, proposes to construct an electric instead of a steam road from Portland into Clackmas County, following the Clackmas River to a point within twenty miles of this city, where a townsite will be located. Power will be secured from the river for the generation of electricity.

AVOCA, PA.—The Spring Brook Lumber Company, of Moosic, is installing a 37½-hp additional capacity in individual motors, making the total capacity 57½-hp in its mill at the present time. The Dr. Vorhees Awning Hood Company, of this place, is erecting a new factory which will be operated by electricity. Wagner single-phase motors will be used. The Standard Electric Light, Heat & Power Company will furnish electricity for operating both of the above plants. Frank Howard is superintendent of the lighting company.

BROWNSVILLE, PA.—The West Penn Electric Company will extend its lines to Footdale to connect with the West Penn lines at that point. W. E. Moore is manager.

CONEMAUGH, PA.—Thirty Jandus alternating-current multiple 110-volt lamps will be installed in the municipal electric lighting system. C. J. Groos is superintendent.

HOOVERSVILLE, PA.—Telford Lewis, a representative of the Somerset Mining Company, at Hooversville, has petitioned the Council for a franchise for an electric light plant.

JOHNSTOWN, PA.—The Citizens' Light, Heat & Power Company is contemplating the purchase of a 1000-kw generator for its plant. J. W. Reeves is general manager.

OLD FORGE, PA.—The Old Forge Silk Company is installing an electric plant to operate its mill by electricity. The equipment consists of a 125-kw Allis-Chalmers generator, two 50-hp motors, Harris Corliss engine, Coatesville boilers and about 300 lamps. The work will be completed about April 1. Frank Howard, of Avoca, has charge of the work.

PITTSBURG, PA.—Plans are being made by the West Penn Railways Company to extend its traction lines from McKeesport to Glassport. The company will also build an extension of its line from McKeesport to East Pittsburg by the way of Wilmerding and Turtle Creek.

RENFREW, PA.—A charter has been issued for the Burton Telephone Company, capitalized at $5,000. The directors are William J. Burton, Joseph L. Campbell, Langdon S. Riley, Penn township; Robert J. Marks, Middlesex township, and Thomas J. Shufflin, Butler.

WEST YORK, PA.—The Borough Council has granted a franchise to the York Water & Power Company to erect its lines on certain streets in the borough. The company is to supply electricity to the cement company, which is now erecting a plant in this place.

BISHOPVILLE, S. C.—The Bishopville Light & Power Company has sold its entire plant and system to the town of Bishopville, which will be operated hereafter by the municipality.

CHESTER, S. C.—Surveys and specifications for the local street railway lines of the Chester Traction Company will soon be completed, when the company will be ready to receive bids for the work. The road will be operated by electricity and will need complete equipment. The James D. Labor Company, of Washington, D. C., has charge of the work.

SPARTANBURG, S. C.—The Southern Power, Electric & Manufacturing Company, which is developing several water powers near Spartanburg, S. C., is seeking to get a franchise from the town to furnish electricity for lighting and power purposes.

WAGNER, S. D.—John Absher and others are considering the erection of an electric railway to Lake Andes.

CHILDRESS, TEX.—J. L. Robertson, of Dallas, has obtained a franchise for an electric light plant in this city.

DALLAS, TEX.—The contract has been awarded for the erection of the power plant at the Baptist Memorial Sanitarium, at a cost of about $20,000.

GAINESVILLE, TEX.—The Merchants' Electric Light & Power Company has filed an amendment to its charter, changing its name to the Gainesville Electric Company, and increasing its capital stock from $25,000 to $50,000.

FORT SAM HOUSTON, TEX.—Bids will be received until April 4 by J. L. Fleming, Constructing Quartermaster, U. S. A., for furnishing and installing electric lighting fixtures in the post exchange and gymnasium, post hospital, officers' club, and double stable guard and shop buildings, and for furnishing pole lines and making service connections to all the buildings.

SEGUIN, TEX.—The City Council has under consideration a proposition to purchase the Treole electric light plant at a cost of $50,000.

CAVENDISH, VT.—W. N. Wheelock, of Claremont, N. H., is engineer for the power plant contemplated for Cavendish, which will supply electricity to Claremont industries.

BRISTOL, VA.—There are now two propositions before the Bristol Board of Trade looking to the furnishing of electricity in this city for lighting and power purposes. One has been presented by Charles Hansell & Company, of New York, and the other by Dr. M. L. Fowler and associates, of Bristol. The former propose to construct a dam across Holston River at Fishdam, ten miles east of Bristol, and the latter propose to construct a similar dam near Bluff City, ten miles west of Fishdam and eleven miles south of Bristol.

BURKE'S CREEK, VA.—Efforts are being made to have an electric railway built from Burke's Garden and Cove Creek to Bluefield. Professor A. S. Greever, of Burke's Garden, and others are interested in the project.

MANCHESTER, VA.—The City Assemblymen on March 9 adopted the report of the committee on light, recommending that the city pay $54.75 for each arc lamp, the number not to exceed 70 lamps for each year. The Virginia Passenger & Power Company has for five years furnished the city lamps free of charge.

BELLINGHAM, WASH.—The Whatcom County Railway & Light Company has submitted a proposition to the City Council to lease the municipal electric plant for a term of five years.

SEATTLE, WASH.—Bids will be received until April 30 by James Knox Taylor, supervising architect, Washington, D. C., for installing a conduit and wiring system for the United States courthouse, custom house and postoffice at Seattle.

SEATTLE, WASH.—It is reported from New York that plans, specifications and estimates are on for the complete electrical equipment and construction of the large electrical power plant on the Nisqually River for furnishing power for railroad car shops to be constructed at Tacoma are being prepared by the Westinghouse Electric & Manufacturing Company for submission and acceptance to H. E. Salsich, president of the Salsich Lumber Company, which is to build the plant.

SPOKANE, WASH.—M. A. Crumbacher, of the Pacific Telephone & Telegraph Company, announces that plans have been completed to install a common battery system at Dayton, Wash., to cost $15,000.

SPOKANE, WASH.—G. W. Thompson, a stockholder of the Lewiston & Southeastern Electric Railway Company, announces that the

Schofield Company, of Philadelphia, Pa., will build the system of the above company, which, together with the power house on the Salmon River, will cost $5,200,000. He also states that construction work will commence this summer.

SPOKANE, WASH.—The stockholders of the Washington Water Power Company have voted to increase the capital stock of the company from $5,000,000 to $10,000,000. Henry M. Richards, president of the company, announces that the money will be expended in the betterment of the electric railway system and the extension of several lines. The officers of the company re-elected for the year are: Henry M. Richards, president; A. B. Campbell, first vice-president; D. L. Huntington, second vice-president and general manager; H. L. Bleeker, secretary; H. E. Perks, treasurer.

TACOMA, WASH.—A. L. Thorn, city electrician, writes that about $100,000 will be expended this year in improvements.

TACOMA, WASH.—A franchise has been granted to the Tacoma Railway & Power Company by the City Council to construct a street car line to Bismarck. The company has also received franchises to build and operate electric lines on various streets of the city.

TEKOA, WASH.—The Saint Maries River Railroad Company is planning to extend its line from Tekoa to Indian Creek. The line will be operated by electricity and a local system will be operated in Tekoa. The line will ultimately be extended to St. Maries River, Idaho.

TUMWATER, WASH.—The Olympia Brewing Company is planning to install a large electric power plant to furnish electricity for light and power for the brewery and to furnish electric light to the town of Tumwater. The company will install gas engines.

WHEELING, W. VA.—The Bellaire Southwestern Traction Company has increased its capital stock from $10,000 to $500,000.

AMHERST, WIS.—The Amherst Telephone Company has increased its capital stock from $2,500 to $6,000.

HATFIELD, WIS.—The La Crosse Water Power Company has filed a mortgage to raise funds with which to build a dam across Black River at Hatfield for the purpose of generating and transmitting electric and hydraulic power.

NEWTON, WIS.—The English Lake Telephone Company has filed articles of incorporation with a capital stock of $2,100. The incorporators are Ernst Onsorge, Alexander J. Duvenek, Herman Goght and Carl Jacob.

RACINE, WIS.—The Milwaukee Electric Railway & Light Company has abandoned the proposed erection of the power plant at the corner of Lake Avenue and Second Street in this city.

BRANTFORD, ONT.—The Ham & Nott Company is planning to erect a new building and power plant at a cost of $100,000.

BATTLEFORD, SASK.—Bids will be received until April 15 for the construction of water works, a sewerage system and electric light plant. Address, City Secretary and Treasurer.

COLLINWOOD, ONT.—The corporation of Collinwood is contemplating increasing the capacity of the municipal electric lighting plant. T. Bassett is superintendent.

DUNVILLE, ONT.—The Dunville Independent Telephone Company has been incorporated with a capital of $60,000. The incorporators are: R. A. Harrison, T. Marshall and A. W. Haun, all of Dunville.

EDMONTON, CAN.—R. R. Keeley, city engineer, has recommended that the council purchase a 900-hp engine to run the city plant at an estimated cost of $12,000. Address Mayor Griesbach.

LETHBRIDGE, CAN.—The Lethbridge Electric Company has decided to spend $25,000 this year in improvements to its plant. M. Freeman is managing director. The following officers were elected at the recent annual meeting: F. H. Mewburn, president; T. D. Kevin, vice-president; H. MacBeth, secretary and treasurer, and M. Freeman, managing director.

WINDSOR, ONT.—It has been decided that the Windsor light department is to be conducted by a commission with the same powers as the Water Board. The light committee of the City Council will turn over the plant to a body of three men.

WINNIPEG, MAN.—Cecil B. Smith, civic power expert, has received instructions from the civic power committee to call for all tenders necessary for the construction of the Point du Bois power plant by April 1. The estimated cost of this work is $3,500,000.

WOODSTOCK, ONT.—The City Council and Railway and Municipal Board are said to have under consideration the extending of the municipal electric light plant at a cost of $9,000.

CAMPECHE, MEX.—A franchise has been granted to L. B. Speyer & Company by the city of Campeche, granting them the exclusive privilege to furnish electricity for lighting and power for a term of 20 years. A company will be formed with a capital of $300,000 to build the plant, which will be financed by L. B. Speyer & Co.

GUANAJUATO, MEX.—The Guanajuato Power & Electric Company has decided to amend its articles of incorporation so as to increase the capital stock from $3,000,000 to $3,500,000. The new stock issue of $500,000 is to be exchanged for the entire capital stock of the Michoacan Company. The Michoacan Company owns a concession from the Mexican Federal Government, covering two water powers on the Angulo River, about thirty-five miles east of the present plant of the Guanajuato company.

PINOS ALTOS, MEX.—The owners of the Pinos Altos mines are preparing to erect a hydro-electric power plant about three miles from the town.

SALTILLO, MEX.—The Saltillo Electric Light & Power Company has decided to increase its capital stock to $200,000.

Company Elections.

ANTWERP, OHIO.—At the annual meeting of the Antwerp Telephone Company, the following officers were chosen: P. P. Doering, president; C. A. Lindemuth, vice-president; J. H. Finley, secretary and treasurer.

COLUMBUS, OHIO.—At a meeting of the directors of the Columbus Citizens' Telephone Company the following officers were elected: Henry A. Lanman, president; John Joyce, vice-president; Edwin R. Sherp, secretary and treasurer, and Gansley R. Johnston, general manager.

CROOKSVILLE, OHIO.—At the annual meeting of the Crooksville Telephone Company, held recently, the following named officers were elected: J. B. Rhodes, president and general manager; T. F. Wilson, vice-president; William Harris, secretary; J. L. Bennett, treasurer.

CHARLESTON, S. C.—At the annual meeting of the stockholders of the Savannah River Power Company the present board of directors was re-elected. Mr. H. A. Orr was re-elected president; Mr. C. Elmer Smith, vice-president; Dr. S. M. Orr, treasurer, and Mr. E. K. Chapman, secretary.

DAYTON, OHIO.—At the annual meeting of the Home Telephone Company of this city officers were re-elected as follows: J. T. Barlow, president; H. C. Kiefaber,, vice-president; J. C. Reber, secretary and treasurer.

FREDERICTON, N. B.—A special meeting of the directors of the New Brunswick Telephone Company, held recently, Dr. A. A. Stockton was elected president, and W. T. Whitehead, vice-president.

GILLESPIE, ILL.—At the annual meeting of the South Chenoa Telephone Company the following officers were elected for the coming year: C. J. Gillespie, president; J. F. Johnson, treasurer; Thomas Boyd, secretary.

HONOLULU, HAWAII.—At the annual meeting of the stockholders of Hilo Electric Company, held Jan. 26, the following were elected officers and directors: John A. Scott, president; C. C. Kennedy, vice-president; N. C. Willfong, treasurer; W. T. Balding, secretary; R. I. Lillie, auditor; with O. H. Shipman, Levi C. Lyman and Alex. Valentine, directors.

HONOLULU, HAWAII.—At a meeting of the Kaurai Railway Company, Ltd., held recently, the following officers and directors were elected: F. M. Swanzy, president; H. M. von Holt, vice-president; T. C. Davies, treasurer; E. H. Wodehouse, secretary. The above with W. A. Kinney and W. F. Dillingham, directors.

NEW CONCORD, OHIO.—At the annual meeting of the directors of the New Concord Telephone Company, the following named officers were chosen: S. C. Herdman, president; J. E. McClelland, vice-president; J. B. Rhodes, secretary and treasurer.

ST. LOUIS, MO.—At the annual meeting of the stockholders of the Bell Telephone Company of Missouri, held recently, the old board of directors was re-elected as follows: James Campbell, W. Duncan, G. F. Durant, F. P. Fish, C. S. Gleed, J. A. Holman, P. C. Maffit, D. S. H. Smith, C. P. Walbridge, Edwards Whitaker and C. E. Yost.

New Industrial Companies.

THE AMERICAN ELECTRIC LAMP COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $50,000 by J. J. O'Donohue and others.

THE BANDON ELECTRIC COMPANY, has been incorporated at Portland, Ore., by Edward G. Ammo, Clayton E. Hallopeter and William H. Hallopeter. The capital stock of the company is $10,000.

THE CANADIAN ENGINEERS, LTD., of Ottawa, Ont., has been incorporated with a capital of $60,000 to carry on a general business as mechanical, civil, electrical, mining and consulting engineers. The incorporators are: T. T. Simpson, R. W. Farley and S. J. Chapleau, all of Ottawa, Ont.

THE ELECTRIC SHOE POLISHER COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $500,000 by Mervin M. Chesrown, Theodore Rurode and Charles C. Kelly.

THE JOHN O. STIVERS ELECTRICAL COMPANY, of Denver, Col., has been incorporated with a capital stock of $100,000 by John O. Stivers, Henry Broadhurst and others.

THE KIRK-HABICHT COMPANY, of Baltimore, Md., has been organized to deal in electrical supplies and iron and brass merchandise, has been incorporated by Charles E. Kirk, William C. Habicht, George W. Wilson, Arthur A. Bregel and George A. Solter. The capital stock is $5,000.

THE LITCHFIELD CONNECTICUT ELECTRIC SUPPLY COMPANY, of Litchfield, formally announces its change of name to the Connecticut Electric Manufacturing Company of Litchfield.

THE MUNICIPAL CONTROL COMPANY, of New York, N. Y., has filed articles of incorporation with the Secretary of State, with a capital stock of $1,000. The directors are J. D. MacAno, J. Donohue and V. A. MacAno, New York, N. Y.

New Incorporations.

SAN FRANCISCO, CAL.—The Lincoln Northern Railway Company has filed articles of incorporation with a capital stock of $11,200. The incorporators are E. E. Calvin, William F. Herrin, William Hood, N. T. Smith and J. L. Willcutt.

DENVER, COL.—Articles of incorporation have been filed for the Walsenburg & Western Railway Company with the Secretary of State. The company is capitalized at $100,000, and the incorporators are: E. W. Griffith, L. E. Rowland, F. E. Guy, George C. Barnard and F. J. Jackson, all of Denver.

DENVER, COL.—The Yampa Telephone Company has been incorporated with a capital stock of $10,000 by Arnold Powell and others.

NORWICH, CONN.—The Norwich Electric Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are Charles J. Twist, James M. Fullmore, Carroll L. Adams, all of Norwich.

WASHINGTON, D. C.—The Washington, Spa Springs & Gretta Railroad Company has filed articles of incorporation with a capital stock of $20,000. The incorporators are: James C. Rogers, Benjamin D. Stephens, Fillmore Beall, J. Enos Ray, Jr., and Marion Duckett, all of Prince Georges county.

BRISTOL, IA.—The Bristol Mutual Telephone Company has been incorporated with a capital stock of $2,500 by D. J. Marriam and others.

DAVENPORT, IA.—The Davenport & Burlington Interurban Company and the C. G. Hipwell Construction Company have been incorporated, each with a capital stock of $250,000. C. G. Hipwell is president of both companies. The latter company, it is stated, is formed to build an interurban line from Davenport to Burlington, which the first named company will own and operate.

FARLIN, IA.—The Bristol Mutual Telephone Company has been chartered with a capital stock of $2,500 and the following officers: D. J. Merriam, president; J. R. Mathews, vice-president; E. A. Cairns, secretary, and C. F. West, treasurer.

LA PORTE, IA.—The La Porte City Farmers' Mutual Telephone Company has been incorporated with a capital of $24,000 by O. A. Wallace and others.

MONMOUTH, IA.—Articles of incorporation have been filed for the Keystone Monmouth Telephone Company with a capital stock of $2,000. B. B. Staggs is president.

BOISE, IDAHO.—Articles of incorporation have been filed for the Great Shoshone & Twin Falls Water Power Company. The company is capitalized at $1,500,000. W. S. Kuhn is president.

DWIGHT, ILL.—Articles of incorporation have been filed with the Secretary of State for the Home Telephone Company, with a capital stock of $1,500, by R. E. Bunting, John Hoffman and M. B. Butz.

HOYLETON, ILL.—The Rixman Telephone Company has filed articles of incorporation with a capital stock of $2,500. The incorporators are H. W. Rixman and others.

HEYWORTH, ILL.—The Heyworth Electric Light & Power Company has been incorporated by Charles Crump, Thomas C. Carroll, and others.

MASCOUTA, ILL.—The Southern Illinois Long-Distance Telephone & Telegraph Company has filed articles of incorporation with a capital stock of $2,500 by F. G. Wombacher, H. Y. Liebig and C. R. Harris.

PLUM HILL, ILL.—The Plum Hill Telephone Company has been incorporated with a capital stock of $805. The incorporators are Henry Sachtelben, John Brinkman and F. H. Lussenheide.

ST. ELMO, ILL.—Articles of incorporation have been filed for the St. Elmo, Springfield & Northern Railway by P. M. Joseph and others.

WATERLOO, ILL.—Articles of incorporation have been filed for the North Dunkerton Telephone Company with a capital stock of $5,000. Thomas Dunkerton is president.

ANDREWS, IND.—The Home Light & Power Company, of this city, has filed articles of incorporation with the Secretary of State.

BLUFFTON, IND.—The Bluffton, Geneva & Celina Traction Company has been chartered with a capital stock of $30,000 for the purpose of building an interurban line from this city to Celina. The incorporators are D. W. Brown, B. F. Cummins and others. The company will soon call for bids for the construction of forty miles of railway.

BLOOMINGTON, IND.—The Farmers' Telephone Company has been incorporated. William R. Smith, John A. Knight, Morton Payne and S. J. Woodard are the directors.

INDIANAPOLIS, IND.—Articles of incorporation have been filed with the Secretary of State for the Terre Haute, Indianapolis & Eastern Traction Company. Plans have been completed for the merger of another group of interurban properties by the syndicate owned by the syndicate headed by Hugh J. McGowan. The properties to be absorbed by the new company include all the traction lines between Indianapolis and Terre Haute and the city lines of Terre Haute. The new company is capitalized at $100,000 and the officers are Robert I. Todd, president; Thomas B. McCarthy, vice-president; William S. Milholland, secretary and treasurer; directors, Fletcher M. Durbin and R. E. A. Foley.

ROACHDALE, IND.—The Citizens' Co-operative Telephone Company has been incorporated with a capital stock of $2,000. The directors are T. E. Tobin, G. W. Stewart, W. F. Davis, J. W. Miller, W. H. Dean, S. R. Batman and J. E. Crosby.

BELLEFONTAINE, OHIO.—Articles of incorporation have been issued to the Logan County Farmers' Telephone Company, which is capitalized at $5,000. W. J. Dachenbach is one of the incorporators.

BRADNER, OHIO.—The Bradner Telephone Company has been incorporated with a capital stock of $20,000 by M. M. Fowler, A. A. Stump, A. D. Fowler, E. E. Hyter and others.

BROWNSVILLE, TENN.—Articles of incorporation have been filed at Augusta, Me., for the Brownsville Light & Power Company with a capital stock of $30,000 by Lewis A. Burleigh, J. Berry, E. L. McLean and P. O. Cross, of Augusta, Me.; William Thomas and Norman M. Byars, Brownsville, Tenn.

AMITE CITY, TEX.—The Central Light & Power Company has been incorporated with a capital stock of $10,000. The company proposes to build a power and ice plant.

AMARILLO, TEX.—Articles of incorporation of the Amarillo Street Railway Company have been filed with the secretary of state with a capital stock of $250,000. The directors are: J. C. Paul, H. A. Noble, J. W. Crudgington, S. D. Wharton, W. E. Kirk, C. B. Nash, John K. Shireman, all of Amarillo, and John L. Brock and C. C. Harris, of Decatur, Ala.

CISCO, TEX.—The Western Light & Power Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are W. Anderson and others.

AUSTIN, TEX.—The Dallas Interurban Electric Railway has been chartered with a capital stock of $2,400,000. D. E. Waggoner, C. C. Slaughter, C. T. Alexander, R. C. Buckner, J. M. Carter, O. H. Lang and others.

AZLE, TEX.—The Azle Telephone Company has been chartered with a capital stock of $2,000 by Joseph Fowler, J. W. Walker, H. N. Grigsby, W. B. Kitchens and others.

CRAWFORD, TEX.—Articles of incorporation have been filed for the Crawford Telegraph & Telephone Company, with a capital stock of $6,000, by J. B. Nichols, W. D. Sutton and J. W. Gee.

DALLAS, TEX.—The Dallas Interurban Electric Railway Company has been chartered by the Secretary of State to carry out the provisions of the franchise granted by the city of Dallas to J. Mercer Carter and associates. The company nas a capital stock of $2,400,000 and the officers are D. E. Waggoner, president; I. J. Willingham, first vice-president; Sidney A. Stemmons, secretary; M. H. Wolfe, treasurer.

DUBLIN, TEX.—The Dublin Farmers Rural Telephone Company has been incorporated with a capital stock of $20,000 by J. G. O'Brien and others.

EL PASO, TEX.—The Pioneer Telephone Company has been incorporated with a capital stock of $1,000 by E. Lewis and others.

EL PASO, TEX.—The Pleasant View Telephone Company has filed articles of incorporation with a capital stock of $800. The incorporators are: A. W. Shepard, W. H. North and W. G. Stokes.

HEREFORD, TEX.—The Hereford Telephone Company has been incorporated with a capital stock of $6,000 by J. C. Bain and others.

KILLEN, TEX.—The City Light & Power Company has been incorporated with a capital stock of $10,000 by W. R. Burks, W. R. Barber, William Rancier, Samuel Rancier and John McDowell.

MINERAL WELLS, TEX.—The Mineral Wells & Lakewood Park Street Railway Company has filed articles of incorporation with a capital stock of $25,000, for the purpose of constructing and operating an electric railway from this city to Mineral Wells.

PALESTINE, TEX.—The Central Texas Traction Company has been incorporated with a capital stock of $50,000 for the purpose of building an interurban railway between Palestine and Corsicana. The incorporators are J. V. Watkins, William H. Moser and others.

BRISTOL, VA.—The Holston Water, Electric & Power Company has been incorporated here, to develop water power in Holston River, near Bristol, for generating electricity. Dr. M. L. Fowler is president.

CHESTNUT HILL, VA.—The Northside Light & Water Company has been chartered with a capital stock of from $10,000 to $50,000. The officers are as follows: J. T. Goodwin, president; F. F. Rennie, vice-president; H. M. Starke, secretary; C. D. Wilder, treasurer.

NARROWS, VA.—The Giles County Mutual Telephone Company has been incorporated with a capital stock of $5,000. The officers and directors are: H. W. Hale, president; W. O. Coburn, treasurer; E. W. Hobbs, general manager. The directors are: M. F. Brown, F. W. Gearheart, T. M. Guinn, J. H. Woolwine, all of Narrows.

ROANOKE, VA.—The Roanoke Heat, Light & Power Company has been chartered with a capital stock of $500,000. The officers of the company are: James P. Woods, president; James C. Martin, vice-president; H. T. Hall, secretary and treasurer.

MAPLE FALLS, WASH.—The Maple Falls Telephone Company has been incorporated by John P. Ashland and others.

OTTAWA, ONT.—The Dominion Power & Transmission Company has been organized with a capital stock of $25,000,000 by Stellar Lovell and others.

DODGEVILLE, WIS.—Articles of incorporation have been filed with the Secretary of State for the Arena & Ridgeway Telephone Company with a capital stock of $3,000 by A. W. McKenzie and others.

Legal.

METER PATENTS.—The United States Circuit Court of Appeals in Chicago filed an opinion on Jan. 31 last in the case of the Westinghouse Electric & Manufacturing Company vs. the Diamond Meter Company. In this cuit, brought for the infringement of Tesla patents No. 511,559 and No. 511,560, the Court below granted injunctions against the Diamond Meter Company, stopping its manufacture and sale of alternating-current indicating wattmeters, commonly known to the trade as "Scheoffer Meters," and the present opinion of the Court of Appeals affirms the action of the lower Court in placing the Diamond Meter Company under injunction. This decision is the last of a long series of favorable decisions as to the validity of these patents and their applicability to split-phase meters for power purposes. The opinion gives full credit to Mr. Telsa for the invention of the split-phase idea of operating meters.

REIST PATENT FOR ARMATURE CORE HELD INVALID.—The decision of the United States Circuit Court upholding the validity of the Reist patent, No. 508,637, for an armature core, has been reversed by the Circuit Court of Appeals on the ground that the device patented does not disclose patentable invention. Reist claimed to have invented a new and useful improvement in the construction of armature cores whereby ample ventilation is obtained for dissipating the heat generated thereon without detriment to the inductive qualities of the core. It was stated that the invention was principally intended for dynamo-electrical machines in which the armature revolves inside the stationary magnetic field but that it could also be used in a machine in which the field was the revolving member and the armature stationary. The defendant company, which was being sued for an infringement, defended on the ground that the patent was invalid for the reason that it disclosed no new idea, but only the mechanical skill which one conversant with the subject and with what had already been pointed out as a means of meeting the difficulty might be expected to supply. This contention met favor with the court and it was held that the Reist device, designed, as it was, to secure ample ventilation by the use of thin metal separators between the sections or laminæ, of which the core is built up, was merely the carrying forward of the idea of prior devices by the use of the same means changed only in form or degree and did not involve the exercise of the inventive faculty. A skilled workman may, in improving a device, cut away needless bulk, increase the size of the parts, make them stronger by the substitution of one familiar material for another, make them lighter or heavier, and so on, but this does not involve invention. Bullock Electric Manufacturing Company vs. General Electric Company, 149 Fed. Rep. 409.

CONTRIBUTORY INFRINGEMENT OF PATENT.—A recent decision has been handed down by the United States Circuit Court, involving the patents covering a machine used for duplicating purposes and known as the Edison Rotary Mimeograph. About eleven thousand of these machines had been sold at the time of the suit under a license restriction lettered upon a metallic plate attached to the machine and reading as follows: "This machine is sold by the A. B. Dick Company with the license restriction that it may be used only with the stencil paper, ink and other supplies" made by the manufacturers of the machine. The action was brought by the manufacturers to restrain an infringement of their patent by the defendants. It appeared that the defendants were in the business of selling supplies for mimeograph machines, which supplies were of their own make, and had sold a can of ink to the owner of one of the plaintiff's machines to be used in working the machine. The owner of the machine was instructed by one of the defendants to place the ink in one of the plaintiff's cans and to throw the original can away. It was held that the defendants were guilty of a contributory infringement of the plaintiff's patent, a contributory infringement being an intentional aid or co-operation in transactions, which collectively constitute complete infringement. For example, where a person furnishes a machine which is useful only for the making of a patented article, intending that it shall be thus used, that person is himself liable for any infringement which is afterwards committed in the manufacture of that article with that machine. The owner of a patent may use the patented article or not use it as he pleases. If he sells it he may restrict its use in any way he sees fit, however ridiculous such restriction may seem, so long as he violates no law in so doing, or commits no wrong, and imposes no obligation upon his licensee to violate a law or commit a wrong. A. B. Dick & Co. vs. Henry, 149 Fed. Rep. 424.

RIGHT UNDER STATUTE TO RECOVER PENALTY FROM TELEPHONE COMPANY FOR UNREASONABLE DISCRIMINATION.—The statutes of the State of Arkansas provide that it shall be the duty of every telephone company doing business within the State to supply all applicants for telephone connections and facilities with such telephone connections without discrimination or partiality, provided such applicants comply with the reasonable regulations of the telephone company, and upon a failure on the part of the company to do so a penalty of $100 for each day of discrimination is provided. A subscriber who claimed that he had been discriminated against for a period of one year brought an action under this statute to recover $36,500 in penalties from the Batesville Telephone Company. He complained that while other subscribers to the telephone exchange were permitted to be connected from their respective residences and places of business with points out of town for the purpose of transmitting messages over the long distance lines connecting with the exchange, bills therefor being rendered at the end of each month, he, the plaintiff, was compelled to go to the central office of the exchange and pay cash in advance before he would be permitted to talk over the long distance lines. The company demurred to the complaint and a judgment in its favor was made in the lower court but, on appeal, the Supreme Court reversed the decision and directed that the demurrer be overruled. While it was the right of the telephone company, as a creditor, to determine at what time it should be paid, it was held that the requirement that the plaintiff should first go to the central office of the exchange and pay in advance for his long distance messages, when it was not required of other subscribers, was an unreasonable and unnecessary discrimination and was forbidden by the statute. Yancey vs. Batesville Telephone Company, Supreme Court of Arkansas, 99 S. W. Rep. 679.

ACTION AGAINST TELEGRAPH COMPANY FOR TRANSMITTING LIBELOUS MESSAGE.—Upon the appearance in a Vicksburg, Miss., newspaper of an article mentioning, among others, the name of an Ex-United States Senator, the Ex-Senator took occasion to express his dissatisfaction in a telegraphic message directed to the editor of the offending paper and worded as follows: "Your article in issue of Thursday is a dirty lie as you know. Who is responsible? You nasty dog. Answer." This message was handed in to the office of the defendant telegraph company at Oxford, Miss., but no agent of the company was present and the message was received and forwarded by a boy who sometimes assisted the regular agent in his duties. The message was received at Memphis, where it was written out and then forwarded to Vicksburg. It was there handed to a messenger boy who made a letter press copy of it and delivered it to the party to whom it was addressed. The editor, after exploiting the message in his paper and making editorial reply, concluded to avenge his injured feelings by bringing suit against the only innocent party in the transaction, the telegraph company, to recover damages as for a libel. Though telegraph companies have no right to receive and transmit libelous messages, that question did not arise in this case, as the boy who first received and started the message was not an agent of the telegraph company, for whose acts the company could be held liable. The message got into the way of transmission over the company's wires without preliminary reception and authorization by the company or its authorized agent and thereafter it was handled as a matter of routine by the company's agents who were bound to secrecy by the statutes of the State of Mississippi. In order to establish a liability for libel on the part of the company it was necessary to show that the libelous matter had been published in a legal sense. The only circulation of the message, it was held, occurred when the same was copied by the messenger boy in the company's office and this did not amount to a publication for the reason that it was not shown that the boy had read the message. The next step was the delivery of the message to the addressee, and, as it is well settled that the communication of the libelous words to the person defamed does not constitute a publication, there appeared to have been no publication at all and the company was held free of liability. Western Union Telegraph Company vs. Cashman, United States Circuit Court of Appeals, 149 Fed. Rep. 367.

DAMAGES FOR MENTAL ANGUISH.—Upon the question of the right to recover damages from a telegraph company for a failure on the part of the company to deliver a telegram with due promptness, whereby the sender or other party is subjected to great mental pain and anguish the jurisdictions of this country are not in accord. In Iowa, Texas, Tennessee and in some other States the rule obtains that damages for mental anguish, unaccompanied by bodily suffering, may be recovered, even when the mental suffering is caused by the mere neglect of a telegraph company, or other corporation or individual. This rule seems to be a departure from the common law and the reasons given for it are not persuasive. In the main, they are that the elasticity of the common law is such as will admit of the application of its principles to new conditions as they arise in the advancing civilization; that the telegraph is a public utility of modern invention, endowed by the State with special privileges, and charged with public duties; that neglect in the performance of its duties may cause mental anguish to those it is required to serve; that, therefore, the principles of the common law should be so extended as to permit a recovery of damages for mental anguish when it is caused by such neglect. But, in the latest decision on the point, U. S. District Judge Reed remarks that "mental anguish is older than the new civilization, and the negligent cause thereof has been the subject of frequent consideration by the common law courts, and it is the settled rule of these courts that such anguish, unaccompanied with bodily injury, is too intangible and too remote to form a basis for the recovery of damages." If one, who is caused to be absent from the funeral of a near relative by a telegraph company's failure to promptly deliver a message, may recover damages from the company for the mental suffering occasioned, then he ought to have the same right of recovery against a railroad company, if his absence were caused by a negligent delay in the operation of the trains. To permit of the recovery of damages for mental suffering alone, as is done in some States, it is not an example of the ap-

plication of old principles to new conditions, but is the creation of a new right of recovery unknown to the common law and, as such, should be the function of the legislatures and not of the courts. Judge Reed, in his opinion in the recent decision mentioned, goes on to state that damages for mental anguish are ordinarily allowable only: (1) When there has also been bodily injury causing physical pain; (2) where there has been a malicious, intentional or willful invasion of the legal rights of another, the natural result of which is mental suffering, in which case damages are allowed, not as compensation for the injured feelings, but rather by way of punishment for the wrongdoer. Rowan vs. Western Union Telegraph Company, United States Circuit Court, 149 Fed. Rep. 550.

Obituary.

COL. A. F. RAMY, banker, capitalist, president of the Indianapolis Crawfordsville & Western Traction Company, and president of the Crawfordsville Telephone Company, died at Hot Springs, Ark., March 12 and was buried from his home in Crawfordsville, Ind., March 15. He was at the head of several other enterprises and his energy and financial backing made them prosperous.

MR. J. CARROLL.—The death is announced, on March 12, of Mr. James Carroll, superintendent of the Suburban Electric Light Company, of Scranton, Pa., after a brief illness. He was one of the best known men in the city and had been a faithful employe of the company for twelve years. About a year ago he was promoted to superintendent of the company. Surviving him are his widow and four children.

Personal.

MR. JOHN I. BEGGS is likely, it is rumored, to succeed E. G. Cowdery as vice-president and general manager of the Laclede Gas Co., St. Louis, Mr. Cowdery taking the management of the People's Gas Company, of Chicago.

MR. HERBERT G. EASTWOOD, of the electrical department of the Toledo (Ohio) Gas, Electric & Heating Company, has resigned and accepted a position as electrician in government employ on the Panama canal, to which point he has already sailed.

MR. G. F. ARCHER, of New York City, has lately completed the installation of 115 lamps in the residence of Mr. Wm. A. Redding, on West End Avenue, New York. He has also recently completed a thoroughly up-to-date electrotyping installation. There are eighteen machines, each directly driven by a Sprague motor.

MR. C. E. WHITE, manager of the municipal lighting plant of Walpole, Mass., has accepted a proposition from the H. L. Doherty Company, of New York, to become connected with its interests in Cincinnati, to which city he will remove at once. It is understood that his position will be that of power expert for the middle western territory of the concern.

MR. JAMES GOLDMARK, 83 Warren Street, announces that he now represents the Holtzer-Cabot Electric Company, Boston, Mass., for Greater New York and neighboring cities on its line of direct and alternating current dynamos and motors, buffing and grinding motors, dental lathe motors, dynamotors and motor generators and will carry a full stock of these machines at 83 Warren Street. Mr. Rupert A. Jenks, formerly with the General Electric Company, will answer all inquiries for standard types, also on the application of special motors for all kinds of work.

MR. J. G. ROSSMAN, consulting engineer, formerly located in Atlanta, Georgia, has returned from an extended trip to California, Northwest and Black Hills District of South Dakota, and taken offices in Broad Exchange Building, 25 Broad Street, New York. While in the West he visited a number of electric and water-power plants and inspected some of the properties in which he is interested. Mr. Rossman will continue to make a specialty of examinations, reports, and verification of reports on public utility plants, especially water-power and electrical properties, for banking houses, trust companies and investors.

Trade Publications.

MERCURY ARC RECTIFIERS.—An excellent technical discussion of the properties of mercury arc rectifiers is contained in bulletin No. 4472 of the General Electric Company, N. Y.

DIRECT-CURRENT RAILWAY MOTOR.—Bulletin No. 4474 of the General Electric Company, Schenectady, N. Y., is devoted to the GE-76 railway motor which is a 250-volt machine rated at 160-hp.

POCKET AMMETERS AND VOLTMETERS.—A line of pocket size ammeters and voltmeters for both direct and alternating current is described in bulletin No. 4469 of the General Electric Company, Schenectady, N. Y.

REINFORCED CONCRETE.—The great development in the past few years in reinforced concrete and other cement work is illustrated by a list of books just issued on this subject by the McGraw Publishing Company, 114 Liberty Street. The list contains no less than 32 titles of recent books dealing with reinforced concrete and the manufacture, testing and use of cement.

THE HORSE.—A very clever brochure entitled "The Horse," has been issued by the Joseph Dixon Crucible Company, of Jersey City, N. J. It is really an epitome of horse knowledge and "horsey" language, but the point is cleverly made that Dixon's graphite axle grease is the best thing in the world to use in order to lessen the load on the beast of burden and of sport.

CONTROLLERS.—The Type G. controller of the Electric Controller & Supply Company, Cleveland, O., has just been illustrtated and described in these pages. The company has now brought out Bulletin No. 107, which is devoted specifically to this type in its various sizes, capacities, etc. The bulletin includes detailed instruction as to ordering, shipment, etc.

THE WESTERN ELECTRIC COMPANY, Chicago and New York, is distributing three attractive bulletins exploiting and describing in detail the new lines of "Sunbeam" lamps being marketed by it. The bulletins include "Sunbeam Tantalum" lamps, "Sunbeam Gem" 50-watt lamps and "Sunbeam Gem" high efficiency, high candle power lamps. Copies of these bulletins will be furnished on request.

CRUCIBLES.—A highly interesting pamphlet, beautifully printed and illustrated, has been issued by the Joseph Dixon Crucible Company, Jersey City, N. J., on the subject of "Crucibles: Their Care and Use." The author is Mr. John A. Walker, vice-president of the company. His purpose is to instruct users of crucibles as to their proper use, and the dangers of abuse of crucibles. The pamphlet tells what graphite is, and why crucibles are made of it. It tells why crucibles must be made of flake graphite. It tells why some crucibles are dark and others light, and the importance of that fact. The book is from the Bartlett-Orr press.

GARTON-DANIELS ARRESTERS.—The Electric Service Supplies Company, of Philadelphia, has issued a new edition of its bulletin on Garton-Daniels lightning arresters. The various successive bulletins on the subject thrown together in this form constitute practically a complete treatise, and make very instructive reading, not only as to the specific apparatus, but as to lightning effects and other abnormal discharges. Different types and appliances embodying the Garton-Daniels principles and methods are fully illustrated. Copies of this pamphlet are sent to any inquirer interested in the matter. The bulletin is handsomely printed and is bound in embossed cover with colored lettering.

SILVEY STORAGE BATTERY.—The Dayton Mfg. Co., Dayton, O., has issued catalogue No. 139 in regard to the Silvey storage battery, it being its fourth general catalogue on this subject. The company has been making storage batteries for 16 years past. There is a demand for cells of very small capacity to be used in connection with fire alarm, police telegraph systems, photometers, call bell signals, medical apparatus, gas engine ignition outfits, small central energy telephone systems, isolated lighting plants, etc. To meet this demand the company have placed on the market couples ranging in capacities from 5 to 20 ampere-hours. A couple is composed of one negative and one positive plate joined together by a common lead connector which reaches across between the jars so that the positive plate is connected without a joint to the negative plate of the cell next adjacent. A battery of this kind can be set up in a very short time, as there are no connections to make except at the terminals. The plates are of the "Armored Type" construction, so that the active material is securely retained in place. No separators are required for cells of this class, and on account of the simplicity of design and substantial construction, it is almost impossible for the couples to get out of order, provided that they receive a limited amount of care and attention. The pamphlet gives an abundance of data as to these and other types of plate and cell, all of which are fully illustrated.

INCANDESCENT LAMPS.—Under the title "Lamps On Hand," the New York Edison Company has just issued a handsome pamphlet showing the various kinds of lamps employed on its circuits. The introduction gives details as to prices, etc. Each retail customer of the company is entitled to an incandescent lamp of standard candle power having plain or frosted glass for each lamp socket of their installation and to a reserve supply of 20 per cent of the installation for convenience in making renewals. As incandescent lamps burn out they may be renewed free of charge either by calling at any of the lamp depots and returning the old lamps or by sending a written or telephone request to the nearest branch, securing special delivery or delivery by the company's electric delivery wagons. Lost lamps, or lamps having bulbs broken are replaced at the cost of the consumer. The price represents slightly less than their cost to the company. To those using special lamps having standard bases allowances are made to the extent of the cost of the standard lamps. That is to say the company bears the cost of standard lamps, to which the customer is entitled to free renewals, charging only the net difference in the price of the two respective types. Candelabra lamps are supplied at their cost to the company. Dipped lamps in any shade, carried in the company's supply rooms, furnished free of charge in the same manner that the frosted lamps are furnished. Where colored glass lamps are desired they are furnished at the following prices: Blue or green, 8 to 16 cp, full price, 25 cents, difference, representing the net cost to the customer, 12 cents; 32 cp, full price, 30 cents, difference, 17 cents; red lamps, 8 or 16 cp, full price, 30 cents, difference 17 cents; 32 cp, full price, 40 cents, difference 27 cents. The lamps illustrated are actual size and may be obtained at any of the storerooms of the company.

BENJAMIN ELECTRIC MFG. CO., of Chicago, etc., has issued a very neat little pamphlet in Spanish as to its fixtures, specialties, sunbursts, etc., for incandescent electric lighting. Novelties in great variety, all excellent, are described and illustrated with prices.

MR. W. E. RUNDLE, inventor of the Rundle Graphic Cable Chart, has worked out a standard "cable and manhole" sheet. These sheets, 22 ins. x 29 ins. in size, each record ten miles of cable and are bound in loose-leaf black flexible leather binder. Some of the companies adopting his graphic method are the Interborough Rapid Transit Company, the Manhattan Elevated Railway Company, the New York & Queens County Railway Company, the Niagara Falls Power Company, the United Railways & Electric Company of Baltimore, the Consolidated Gas, Electric Light & Power Company of Baltimore and the London Underground Electric Railways Company.

Business Note.

THE SHEEHY INVENTIONS.—The late Robert J. Sheehy was known as a highly ingenious inventor. Note was made of his death last year in these columns. A number of his inventions were left in a more or less complete form, patented and unpatented. Mr. V. E. Schaumburg, an old friend of the inventor and the family, has a number of models, telegraph instruments, stock tickers, etc., of Sheehy design or principle in his keeping, and these will be sold at auction at the Columbia Storage Warehouses, 56 West Sixty-Seventh Street, New York, on April 6, at 10:30 a. m. Meantime he will be glad to give any desired information on the subject. One piece is a complete working model of an automatic railway signal, by which the conditions of the road ahead are automatically reported to the engineer in the engine cab.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MARCH 12, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

846,430. PROCESS OF ELECTRIC WELDING; Laurence S. Lachman, New York, N. Y. Assignor to Standard Pulley Manufacturing Company. App. filed October 28, 1905. A process of welding together thin metal plates. The thickest plate is embossed with protuberances so that limited contacting areas are provided for the passage of the current during the welding action.

846,464. TELEGRAPHIC INSTRUMENT AND THE LIKE; Alberto Gentili, Veneto, Italy. App. filed July 17, 1905. A key action for a transmitting typewriter, having a pair of rollers which move over a convex surface with insulating segments therein.

846,469. CIRCUIT-BREAKER; Rudolf E. Hellmund, New York. App. filed January 21, 1904. A form of circuit-breaker having a spring impelled lever and a magnetic coil attached to a flat insulating base, and a detent with a weighted arm controlled by said magnet.

846,479. TELEPHONE; Stanislaw A. Koltonski, Boston, Mass. App. filed Dec. 9, 1904. In an electrical switch, a latch having two lateral arms, one arm having a catching-nose bent out of plane of the main body of the latch to avoid interference with a twin latch, and the other carrying a cam; a cam so carried and means for guiding said latch.

846,502. FIRE-ALARM SYSTEM; James G. Nolen, assignor of one-half to Frank B. Cook, Chicago, Ill. App. filed September 24, 1903. Has means for both electrically and pneumatically operating the signal transmitting system, the arrangement being such that a different signal is produced in case of accidental disturbance than is given in case of fire.

846,515. ELECTRICALLY-ACTUATED CLOCK; Ruben W. Smedberg, St. Peter, Minn. App. filed July 9, 1906. A secondary clock having a magnet with a pair of spring blade pawls extending from its armature so as to engage and drive a ratchet wheel when said armature is vibrated by the magnet.

846,521. ELECTRIC FURNACE; Le Roy W. Stevens, Syracuse, N. Y. App. filed September 16, 1905. The combination with the furnace and electrode of an electric furnace of a stuffing box having a chamber for packing surrounding the electrode, and a chamber for circulating water; of a sleeve surrounding the electrode and working in said stuffing box, substantially as set forth.

846,522. POLARIZED ELECTRIC SIGNAL-BELL; William M. Thomas, Chicago. App. filed August 3, 1906. A completely enclosed bug-proof casing is formed by the bell itself which encloses a polarized magnet having an armature with two bell clappers, which strike upwardly against the lower edges of the bell.

846,526. APPARATUS FOR THE PRODUCTION OF PIGMENTS; Clinton P. Townsend, Washington, D. C. App. filed April 18, 1902. In a cell for the production of pigment, an anode, a cathode of relatively reduced area, and means for circulating the electrolyte successfully past the electrodes.

846,533. ELECTRIC CONTROLLER; Ferdinand Volk, Pittsburg, Pa. App. filed September 29, 1906. A form of controller particularly designed for mine and yard locomotives, and vehicles in which movements of the controller arm in opposite directions produce a reversal of the motor.

846,544. ELECTRIC HEATER; Albert H. Bremer, William J. Chattin and August Hoenisch, Philadelphia, Pa. App. filed January 3, 1906. A tank supported in inclined position so that fluids will gravitate therethrough. Has a plurality of resistance elements enclosed in protecting tubes about which the water circulates in its passage.

846,557. TELEPHONE TRUNKING SYSTEM; Francis W. Dunbar, Chicago, Ill. App. filed Aug. 1, 1902. The combination with a trunk-circuit extending between different switchboard-sections of a trunk relay at the incoming end of said trunk energized by current over one limb only of the outgoing end, a second relay energized over one limb only of the incoming end when a connection is established with a called line, and a signal at said incoming end which will be displayed at the actuation of either of said relays, but effaced at the actuation of both, substantially as described.

846,566. HIGH TENSION DIRECT CURRENT ELECTRIC SYSTEM; John S. Highfield, London, England. App. filed Dec. 21, 1906. Generators and apparatus are so grouped as to keep the total voltage of the line at positive and negative potentials of equal value in the respective circuit wires.

846,624. DEVICE TO DISCLOSE OPENING OF THE SHUNT-CIRCUITS OF ELECTRIC METERS; William L. Saunders, Denver, Col. App. filed June 27, 1905. An alarmed device adapted to be incorporated in a meter and which will cause the transmission of a special signal in case the usual meter shunt is tampered with or interrupted.

846,625. ELECTRIC SWITCH; Harry Sawyer, Muskegon, Mich. App. filed July 11, 1904. A double knife blade designed to be strongly and compactly made of steel and having removable copper blades constituting the switch elements.

846,626. CONTROLLER FOR ELECTRIC MOTORS; Frederic Schaefer, Wilkinsburg, Pa. App. filed Feb. 20, 1906. Provides a controller for regulating the electro-motive force and circuit connections for starting and operating alternating current motors. The number of contact members and the length of the transformer leads are reduced to a minimum. Has a sectionally wound transformer and oil bath switch contacts disposed symmetrically thereabout, within the casing.

846,642. PROCESS OF REDUCING METALLIC SULFIDS; Edward L. Anderson, St. Louis, Mo. App. filed Dec. 26, 1905. In the reduction of sulfid ores, the process of subjecting a cathode of the ore to the action of an electric current in an electrolyte capable of dissolving the metal constituent of the ore and forming a soluble salt therewith, decomposing said salt, and depositing the said metal constituent on a suitable undecomposable cathode, substantially as set forth.

846,672. HIGH-PRESSURE ELECTRICAL APPARATUS; Franz Joseph Koch, Dresden, Germany. App. filed Jan. 24, 1906. Relates to vacuum tube rectifiers for alternating currents, and has a special arrangement of circuits including primary and secondary coils.

846,673. ELECTRIC SWITCH; Andrew Koesche, Chicago, Ill. App. filed Dec. 26, 1905. A form of knife blade switch having special compound lever connections by which the break is initially made between carbon contacts with the maximum speed of interruption.

846,684. CIGAR-LIGHTER; James H. Moore, Portland, Ore. App. filed Oct. 2, 1906. A small transformer is connected to an ordinary incandescent lamp circuit, and a suitable switch is provided in a flexibly connected handle to close the primary circuit and induce a secondary discharge.

846,691. THERMAL CUT-OUT FOR ELECTRIC CIRCUITS; Gwy, E. Pa., Baltimore, Md. App. filed Nov. 13, 1906. The fuse box is made with projecting ribs or partitions thereon of such a form that it is impossible to insert a fuse of higher capacity than is intended for the circuit.

846,693. ROTATING MAGNET FOR DYNAMO ELECTRIC MACHINES; Charles A. Parsons, George G. Stoney and Alexander H. Law, Newcastle-upon-Tyne, England. App. filed Aug. 21, 1906. In dynamo-electric machinery, a wound rotor, comprising a shaft having one diameter longer than the other, a core having projecting pole-tips integral therewith and coils on said core, as and for the purposes described.

846,701. SOCKET; Ray Smith, Elkins, W. Va. App. filed July 18, 1906. Details of the switch mechanism of a lamp socket having a porcelain block recessed to receive metallic clips which support the movable parts and establish the connections.

846,703. SYSTEM FOR THE SUPPLY OF CURRENT DEMANDS; Frank W. Springer, Minneapolis, Minn. App. filed Sept 17, 1906. The combination with a primary cell or battery of means for intermittently sending a reverse current through said primary cell or battery, immediately following each battery discharge or series of battery discharges to thereby refresh the same.

846,729. FIRE-ALARM SYSTEM; Miles Connor, Pueblo, Col. App. filed June 22, 1906. Provides means in connection with a fire-alarm apparatus for utilizing the wires for transmitting telephonic and telegraphic signals without operating the fire signal.

846,764. SWITCH; William R. Thompson, South Norwalk, Conn. App. filed April 21, 1906. A switch for closing the circuits of signal boxes for a trolley line. The switch is adapted to be secured above the trolley wire and engaged by the trolley wheel in passing. The mechanism is such as to provide a constant circuit closure notwithstanding different car speeds.

846,778. ELECTRIC-LIGHT HANGER; Franklin E. Christman, Bethlehem, Pa. App. filed Dec. 11, 1906. A spring impelled wheel is secured to the ceiling by a depending bracket. The circuit connections are made through the bearings.

846,779. SIGNALING APPARATUS; Clarence W. Coleman, Westfield, N. J. App. filed October 12, 1905. Relates to semaphore signal apparatus of the type making use of liquid carbonic acid gas as the motive power for the operation. Relates to mechanical details of the piston construction and arrangement.

846,811. IGNITION SYSTEM FOR EXPLOSION-ENGINES; Richard Varley, Englewood, N. J. An improvement in the vibrator construction of the coil box of an automobile. The vibrators are simultaneously adjusted at will so that a hot ignition spark can be obtained in hill climbing, or whenever required, but the current may be reduced in normal running to save battery consumption.

846,827. TELEPHONE SERVICE APPARATUS; Samuel H. Couch, Boston, Mass. App. filed April 12, 1906. In telephone service apparatus the combination with contact make-and-break mechanism and a telephone receiver hook, of stop M latch N and arms P and Q.

846,853. ELECTRIC HEATER; James T. Howell, Seattle, Wash. App. filed May 7, 1906. A resistance wire is sealed within a glass tube and the tube is encased by a copper sheathing. The whole is

then heated enough to soften the copper and the glass, and bent into a spiral form. In this way the resistance element is protected from the air, and the glass is protected against breakage.

846,889. TELEPHONE SYSTEM; Albert K. Andriano, San Francisco, Cal. App. filed March 15, 1905. Detailed features of complete intercommunication system.

846,897. GAS ENGINE; Reuben B. Benjamin, Chicago, Ill. App. filed January 2, 1906. Provides means whereby the speed of the engine may be controlled in proportion to the load on a dynamo driven by the engine. The inlet valve is magnet operated by a branch circuit from the feeders supplied by the generator.

846,901. INSULATED RAIL JOINT; William F. Bossert, Utica, New York. App. filed Nov. 30, 1906. A specially formed casting is adapted to entirely surround the sides and base of the rails at the joint. Intermediate plates of insulating substance are used, together with bolts having insulated bushings.

846,912. CLUSTER SOCKET; John H. Dale, New York. App. filed May 24, 1906. Cluster socket having binding posts or terminals therein to which circuit connections may be made in series or multiple arrangement. In this way single construction can be used as series or multiple socket as required.

846,960. CIRCUIT CLOSING MECHANISM; Thomas W. Small, Cleveland, Ohio. App. filed Jan. 26, 1906. An automatic indicator for street cars adapted to display changing inscriptions indicating the streets of the line. The apparatus is operated by a mechanical connection with a friction roller bearing on the track.

846,969. SHUNT FOR ELECTRIC CIRCUITS. Maurice J. Wohl, New York. App. filed Dec. 13, 1906. Relates to ammeter shunts of the type adapted to provide a divided circuit of fixed resistance. The shunt is enclosed between massive metallic plates of special form so as to keep the temperature constant.

847,003. ELECTRIC FURNACE; Basilius von Ischewsky, Klew, Russia. App. filed Feb. 15, 1906. An electric furnace comprising a hollow cylindrical body having a lining of material which is electrically conductive only at a high temperature, and a plurality of electrodes housed in the cylindrical wall of said body and abutting at their inner ends against said lining.

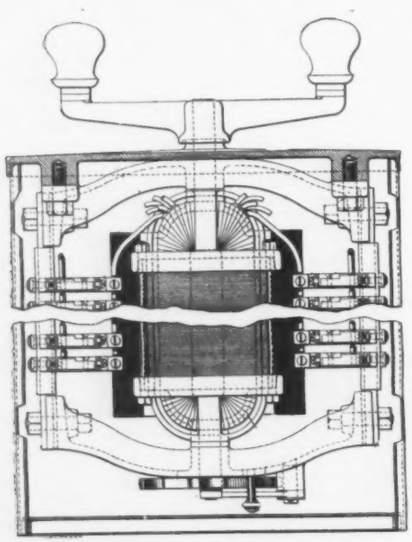
847,007. ELECTRIC SWITCH; Isidor Kitsee, Philadelphia, Pa. App. filed March 19, 1904. Relates to switches in which the contact is made by a positive motion and broken by spring-actuated release motion. Has a spring impelled detent which is released by a button to open the circuit of the switch.

847,008. CONVERTER; Isidor Kitsee, Philadelphia, Pa. App. filed June 10, 1904. A transformer of ordinary construction in all respects except that the core consists of coil or iron wire, the individual turns of which are insulated from one another and the terminals connected to a working circuit.

847,032. PROCESS FOR THE PRODUCTION OF PIGMENTS; Clinton P. Townsend, Washington, D. C. App. filed April 18, 1902. The method of producing white lead which consists in passing an electric current from a lead anode to a cathode through an electrolyte capable of yielding a lead solvent and containing a carbonating agent, causing the electrolyte to flow past an electrode and thence to a point outside the field of electrolysis at sufficient velocity to transport the pigment, and transporting the pigment by such flow, substantially as described.

847,044. THERMOSTATIC CIRCUIT-CONTROLLING DEVICE; Louis H. Britton, Cleveland, Ohio. App. filed Dec. 10, 1906. The thermostat device depends from the ceiling by an ornamental bracket. In case of undue temperature rise mercury passes from a cavity into a position to close the circuit between two contacts.

847,065. BODY TO BE HEATED ELECTRICALLY; Ernst Haagn, Hanau, Germany. App. filed March 16, 1906. Form of crucible adapted to be heated by resistance element embedded in the walls thereof. The resistance element is embodied in organic fabric when it is incorporated in the clay of the crucible.



846,626.—Controller for Electric Motors.

846,853.—Electric Heater.

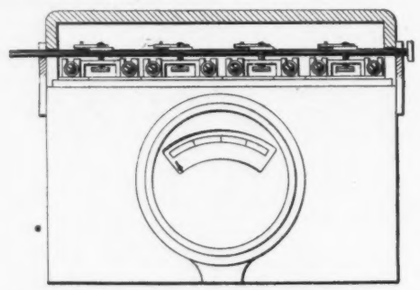
847,079. ELECTROMAGNETIC TRANSMITTING DEVICE; Max Johannet, Paris, France. App. filed Nov. 27, 1906. Dynamo and motor on single shaft connection and having special controllable field circuits.

847,080. INTERRUPTED CONTACT FOR THIRD-RAIL SYSTEMS; Adolph S. Katzman and Henry A. Vizrthann, New York. App. filed Sept. 28, 1906. Form of system where the third rail of trolley is made sectional and only energized during the passage of the train. The switches are mechanical tappets engaged by the train in passing.

847,087. ELECTRIC SWITCH; Gustav W. Linden. App. filed Nov. 23, 1905. Combined knife blade switch and fuse support or receptacle. The switch blades are held in their circuit-closing relations by latches disengaged by special movement of the handle.

847,088. VARIABLE-SPEED ELECTRIC MOTOR; John C. Lincoln, East Cleveland, Ohio. App. filed Jan. 12, 1906. In a variable speed electric motor of the class described the combination with its field structure, of an armature mounted normally to rotate therein, means for effecting the partial withdrawal of the armature axially from said field structure and a heavy spring associated therewith adapted to counterbalance the inward pull of the armature during the period of its withdrawal, substantially as set forth.

847,105. SIGNAL; William H. Parrish, Jr., Nashville, Tenn. App. filed Nov. 3, 1906. Form of luminous signal for railway purposes having four lamps of different colors disposed on the quadrants of a circle, and shutters movable to obscure the appropriate lamps to display danger in caution signals.



846,811.—Ignition System for Explosion Engines.

847,111. STARTING RESISTANCE FOR MOTORS. Henry G. Reist, Schenectady, N. Y. App. filed June 23, 1904. In order to give induction motors a high starting torque patentee has resistances on the rotor which are cut out automatically as the motor comes up to speed. Avoids sliding contacts.

847,153. ALTERNATING CURRENT MOTOR; Ernst J. Berg, Schenectady, N. Y. App. filed Dec. 19, 1903. In combination, an induction motor, a single-phase source of supply, independent supply circuits derived therefrom and connected to the windings of said motor, a condenser and means of variably connecting said condenser to the windings of said motor.

847,157. SIGNALING APPARATUS; Harold Gilbert Brown, West Ealing, London, and Ernest De Merindol Malan, Highgate, London, England. App. filed April 4, 1905. In signaling apparatus the combination with a transmitter of a magazine-receiver and an annunciator that exhibits the transmitted signals in the same sequence and individuality as that in which they were primarily despatched.

847,163. TROLLEY; Thomas Cope, McKees Rocks, Pa. App. filed Nov. 17, 1906. Instead of a trolley wheel patentee has a V-shaped shoe with steel balls inset in cavities in its face to contact with the wire.

847,165. BULKHEAD, DOOR, HATCH OR OTHER BARRIER; William Barnum Cowles, Cleveland, Ohio. App. filed Aug. 18, 1905. System and controller for operating the motors for watertight bulkhead doors and hatches aboard ship, where the current supply is more or less limited and the space available for apparatus is very contracted.

847,170. TROLLEY-STAND; Harry E. Eastman, Richmond, Va. App. filed Jan. 5, 1906. The spring which normally holds pole upward against the wire is disconnected so as to drop the pole in case of sudden upward movement thereof.

847,172. CONTROLLING MEANS FOR SINGLE-PHASE MOTORS; Augustine R. Everest, Lynn, Mass. App. filed June 22, 1906. In combination with a single-phase induction motor, phase-splitting devices for starting said motor, a switch arranged to cut said devices out of circuit and a magnet-winding connected in circuit with the motor and controlling said switch.

847,188. TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed June 18, 1906. Relates to sub-marine telegraphy and aims to improve the signals over lines of considerable capacity. It has a special polarized relay, and means in the local circuit for reversing the connection thereof upon the receipt of each line impulse.

847,189. ELECTRIC TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Aug. 9, 1906. Relates to modifications of the above.

847,197. RELAY; Ray H. Manson, Elyria, Ohio. App. filed May 25, 1904. Has a flux-bar extending longitudinally of the electromagnet, an angular armature pivoted thereto and contact members carried by said flux-bar, one of which is electrically connected to said armature and the other of which makes electrical contact therewith.

847,267. PRODUCING METALLIC SILICIDS; Thomas L. Willson, Ottawa, Ont., Canada. App. filed April 11, 1904. Treating a compound containing iron, nickel and silica, by electrosmelting it with a basic compound and carbon, to produce a ferro-silicid.

847,283. TELEPHONY; Harold J. Fitcher, Hotchkiss, Col. App. filed Aug. 25, 1906. Selective arrangements for party line system.

847,284. COMMUTATOR; John R. Grindrod, Lynn, Mass. App. filed Aug. 1, 1906. The insulating segments of a commutator are thicker at their bases than at their peripheral edges.

847,299. CIRCUIT MAKING AND BREAKING DEVICE. Frederick L. Willard, of New York. App. filed Oct. 2, 1905. Mechanical details of contactor in which the electro-magnet is intended to impel the circuit closing arm by a minimum expenditure of energy.

847,300. PRODUCING METALLIC SILICID; Thomas L. Willson, Ottawa, Ont. App. filed Nov. 5, 1906. Treating a compound containing nickel sulfid by adding a basic compound, silica and carbon, and electro-smelting to form a basic sulfid which slags off, and a nickel silicid.

847,303. ELECTRICAL CONDUCTOR; Frederick Platt, Lynn, Mass. App. filed Aug. 4, 1906. The flexible conductor is inset in a hole in the brush so as to project through the side face thereof at which point it is embedded in solder to secure it in position and make a good electrical connection.